Aquatic Enhancement
& Survey, Inc.

2007 Season
Aquatic Plant Management Plan Update
Fish Lakes
LaPorte County, Indiana

Prepared for the Fish Lake Conservancy District

December 2, 2007




Aquatic Enhancement
& Survey, Inc.
P.O. Box 1036
Angola, IN 46703

1-888-867-5253
260-665-8226
www.aquaticenhancement.com

Acknowledgements

I would like to thank the following for making possible the 2007 season field work and preparation of this update: Jon Dittmar, Thomas Churchman, and the other officers and directors of the Fish Lake Conservancy District, Tony and Leslie Cunningham of Weed Patrol, Inc., Bob Robertson and Gwen White of the Indiana Department of Natural Resources Division of Fish and Wildlife, Dr. Robin Scribailo and Mitchell Alix of Purdue University North Central, Earl Chilton of the Texas Parks and Wildlife Department, Dr**.** John H. Rodgers, Jr., Rob Nelson at ExploreBiodiversity.com, Sally Abella of King County Natural Resources and Parks, Water and Land Resources Division. Aerial imagery was provided by Delorme Mapping and Purdue University. Mapping and G.I.S. images were produced with De Lorme X-map version 5.2. Primary work for this document was performed by Scott Banfield and Cary Abrams of Aquatic Enhancement & Survey, Inc.

Table of Contents

List of Figures

List of Tables

Executive Summary

Fish Lakes in La Porte County Indiana are two connected natural lake basins referred to as Upper Fish Lake (139 acres) and Lower Fish Lake (134 acres). Upper Fish Lake also includes another small basin (Mud Lake) connected to Upper Fish by a Navigable Channel. Both main basins are significantly developed with homes and cottages with Mud Lake also containing some lakeside residences. Residents enjoy fishing, swimming, and boating in the waters of Fish Lake. Both basins of the lake contain a diverse aquatic flora, but have been extensively colonized by the non-native plants Curlyleaf pondweed and Eurasian watermilfoil. For several years these plants have impaired the aesthetic quality of the lake and provided a significant hindrance to the recreational activities of the lake's users. The Fish Lake Conservancy District was formed by the lake residents in 1998 primarily to facilitate the funding of a program to control the lake's nuisance aquatic plants. Beginning in the 2005 season the Fish Lake Conservancy sought cost-share assistance from the Indiana Department of Natural Resources for the management of exotic plants. This update complements the original Indiana Department of Natural Resources Lake and River Enhancement Program (L.A.R.E.) cost-share funded *Aquatic Plant Management Plant Management Plan for Upper and Lower Fish Lakes, La Porte County Indiana* (Weed Patrol Inc. 2005) and associated *Fish Lake Aquatic Vegetation Management Plan Update 2006* (JF New, 2006 & 2007).

In 2007 Aquatic plant management activities at Fish Lake began with the mapping and treatment of 50 acres of Curlyleaf pondweed on May 9. The treatment included areas of both lakes (figure 3 below). This was followed by the mapping and initial treatment of 40 acres of Eurasian watermilfoil on May 22, 2007 (figure 4 below). Treatments for Eurasian watermilfoil regrowth or emerging new growth continued through the season with a total of 80.45 acres receiving treatment by the season's end. Other treatments included two 50 acre treatments for filamentous algae along the developed shorelines of all basins (fig. 5) and an application to control approximately 7 acres of Chara or Slender naiads (fig. 6). Eurasian watermilfoil was mapped and treated on a seek-and-destroy basis multiple times with a goal of reducing or eliminating spread via fragmentation or stolon (root) formation. All treatments showed good results, but it was necessary to retreat Eurasian milfoil regrowth in several areas. A final Eurasian watermilfoil maintenance treatment on November 1, 2007 was experimental, utilizing several herbicides in various lake zones and an untreated control area to allow for a comparison of possible variances in carry-over effects in the 2008 season (figure 8).

For 2008 two possible 4 year treatment regimes are presented as possible ways to effectively provide control of exotic aquatic plants in Fish Lakes. A whole-lake fluridone treatment could be performed in the spring of 2008 to gradually provide lake-wide control of both exotic species by the end of the 2008 season. The cost for the fluridone treatment would be approximately $36052.00. In that case, control of Eurasian milfoil would be expected to carry over to the following season with a minimal amount of growth present in 2009. Curlyleaf pondweed would be expected to return in the previous season's growth pattern in 2009. Because of this, early-season Aquathol K use would be utilized as needed on approximately 60 acres in the 2009-2011 seasons with Systemic herbicides to be used on gradually returning milfoil acreage in 2009-2011. A second option would be to repeat essentially the same program as in 2007, applying Aquathol K liquid early in the season to control Curlyleaf pondweed prior to turion formation, and applying Navigate 2,4-D to Eurasian watermilfoil growth as needed. Assuming a per acre cost of $415.00 for Eurasian watermilfoil treatment and $300.00 per acre for Curlyleaf pondweed treatment, management could be performed for a total 2008 season cost of approximately $51,200.00 under the second option. With option two the program should maintain the funding flexibility to shift herbicide choice in 2008 or future seasons in response to the results of the experimental fall treatment performed in November of 2007.

Figure 1 General Location Map for Fish Lake

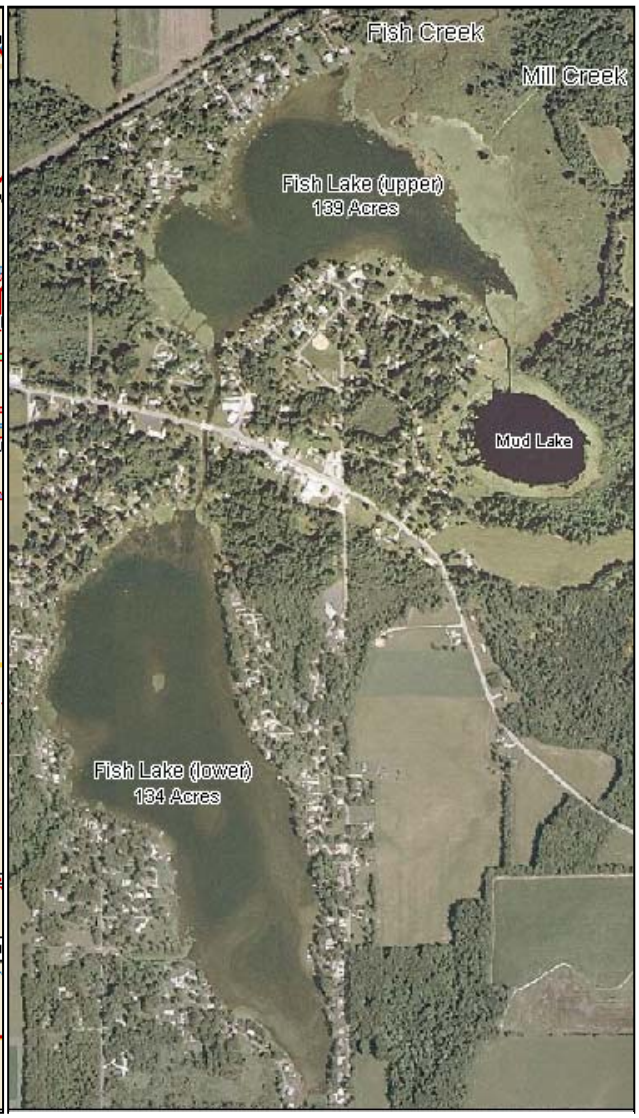


Figure 2 Air photo of Fish Lake area

1.0 Introduction

The purpose of this update is to summarize the results of the 2007 season Tier II surveys, exotic aquatic plant distribution mapping, aquatic plant management activities, and any changes in the Fish Lake watershed or lake-use patterns and use this information to recommend an optimal plant management course through 2011. For a more extensive review of plant management activities prior to 2006 please see the original *Aquatic Plant Management Plant Management Plan for Upper and Lower Fish Lakes, La Porte County Indiana* (Weed Patrol Inc. 2005) and *Fish Lake Aquatic Vegetation Management Plan Update 2006* (JF New, 2006 & 2007). Exotic plant management activities for 2006 and 2007 are listed in the table below. Treatment regimes in 2006 and 2007 were very similar utilizing an early-season Curlyleaf pondweed treatment and repeated treatments with systemic herbicides to control Eurasian watermilfoil. Treatments for Eurasian watermilfoil and Curlyleaf pondweed were jointly funded by the Fish Lake Conservancy District and IDNR Lake and River Enhancement Program. Total treatment Acreage for both exotic plant species appears to have declined slightly from 2006 to 2007.

Year	Total Acres Curlyleaf pondweed Mapped & Treated	Total Acres of Eurasian watermilfoil Mapped & Treated (includes re-treatments. touch-up treatments, and untreated control area in 2007	Total Acres of Treatment for Native Plants/Chara	Total Algae Treatment acres
2006	60	89	<10	Approx. 50
2007	50	80.45	7	Approx. 100
Funding Source	LARE/FLCD	LARE/FLCD	FLCD	FLCD

Table 1 Summary of Plant Management Activities 2006 and 2007

2.0 Watershed and Lake Characteristics

No significant changes in the current year. See *Aquatic Plant Management Plant Management Plan for Upper and Lower Fish Lakes, La Porte County Indiana* (Weed Patrol Inc. 2005)

3.0 Lake Uses

No significant changes in the current year. See *Aquatic Plant Management Plant Management Plan for Upper and Lower Fish Lakes, La Porte County Indiana* (Weed Patrol Inc. 2005)

4.0 Fisheries

On the July 30, 2007 Fish Lake received a stocking of Hybrid Bluegills and Channel Catfish. This is part of an ongoing program to supplement the Lake's naturally produced fish populations. The stocking is sponsored by the Fish Lake Conservation Club. Working to maintain a healthy diverse native plant community as the primary goal of the lake's plant management program will help maximize the recreational value of this private stocking. Also see *Aquatic Plant Management Plant Management Plan for Upper and Lower Fish Lakes, La Porte County Indiana* (Weed Patrol Inc. 2005)

5.0 Problem Statement

See *Plant Management Plan for Upper and Lower Fish Lakes, La Porte County Indiana* (Weed Patrol Inc. 2005) and *Fish Lake Aquatic Vegetation Management Plan Update 2006* (JF New, 2006 & 2007).

6.0 Vegetation Management Goals and Objectives

See *Aquatic Plant Management Plant Management Plan for Upper and Lower Fish Lakes, La Porte County Indiana* (Weed Patrol Inc. 2005)

7.0 Plant Management History

On May 9, 2007 all the Fish Lake basins were surveyed to establish the extent of Curlyleaf pondweed growth, revealing approximately 50 acres of significant growth. This acreage was treated the same day with Aquathol K liquid aquatic contact herbicide. No water temperature was recorded at the time of treatment. Figure three below displays both the area of Curlyleaf growth and the treatment area. They are synonymous. With the exception of the untreated milfoil experimental control areas at the lower end of Lower Fish Lake (November treatment) all significant Curlyleaf pondweed and Eurasian watermilfoil growth was treated in 2007. Figures below display both exotic growth and synonymous treatment areas. A follow-up survey for exotic plant growth was performed on May 22, 2007 showing good control of treated Curlyleaf pondweed and revealing 40 acres of significant Eurasian watermilfoil growth on all the fish lake basins combined. The Eurasian watermilfoil acreage was treated with Navigate granular 2,4-D aquatic herbicide that same day. Figure four below shows the area of treatment/growth. Treatment results were good with treated plants dropping out of the water column

within a few weeks. This was followed up by treatments of nearly the entire lake shoreline (50 acres) on June 25 and again on July 17 for the control of filamentous algae (fig. 5). Aquatic plant surveys were performed in accordance with IDNR's Tier II protocol on the Fish Lake Basins on July 30, 2007. The surveys showed a relatively diverse aquatic plant community with 11 species noted on each lake. Both plant communities were dominated by beneficial native plants. Little Curlyleaf pondweed was noted in the surveys. Eurasian watermilfoil occurred at 2.5 percent of sites on Upper Fish Lake and 12.5 percent of sites on Lower Fish Lake. Dense milfoil growth present during the July surveys was limited to a few small colonies along the northern edge of Upper Fish Lake. On August 15, 2007 approximately one acre of Eurasian watermilfoil regrowth was treated with 2,4-D granular herbicide and about seven combined acres were treated for the excessive growth of the native plant Slender naiad and/or Chara algae (figure 6). On August 24 another follow-up treatment of approximately 10.3 acres of Eurasian watermilfoil was performed on the Fish Lake basins, again with good results (figure 7). After significant growth was noted in the fall of 2007 a final treatment of 29.15 acres of milfoil was completed utilizing four separate herbicides on November 1, 2007 (figure 8). The four herbicides were each used in their own separate mapped zones of the lakes so a comparison of fall-treatment efficacy can be made based on the amount of regrowth occurring in these respective areas in the spring of 2008. An area of Eurasian watermilfoil growth at the South End of Lower Fish Lake remained untreated as an experimental control. Based on treatment results in the 2007 season reasonable treatment response benchmarks for Upper Fish Lake in 2008 would be to hold both Eurasian watermilfoil and Curlyleaf occurrence in a late season Tier II survey to five percent or less. On Lower Fish Lake reasonable 2008 benchmarks would be to hold late season Tier II Curlyleaf occurrence to five percent or less and Eurasian watermilfoil occurrence to 10 percent or less.

2007 Date	Activity	Acreage mapped/treated	Treatment Product/Control method	Dosage	Reported Result
May 9	Curlyleaf mapping (Weed Patrol, Inc.)	50			
May 9	Initial Curlyleaf treatment (Weed Patrol, Inc.)	50	Aquathol K liquid	1 gal/ac	good
May 22	Initial E. milfoil mapping (Weed Patrol, Inc.)	40			
May 22	Initial Eurasian watermilfoil treatment	40	Navigate 2,4-D granular	100 lb/ac	good
June 25	Algae Treatment (Weed Patrol, Inc.)	50	Copper sulfate	2.6 lbs/ac-ft	good
July 17	Algae Treatment (Weed Patrol, Inc.)	50	Copper sulfate	2.6 lbs/ac-ft	good
July 30	Tier II Surveys (Aquatic Enhancement, Inc.)				
August 15	Eurasian watermilfoil treatment	1	Navigate 2,4-D granular	100 lb/ac	good
August 15	Slender naiad/ Chara treatment	5	Reward/Copper sulfate	1 g/ac 2.6 lb/ac-ft	good
August 15	Chara treatment	2	Copper sulfate	2.6 lb/ac-ft	good
August 18	Fish Lake Conservancy, Public Meeting				
August 24	Eurasian watermilfoil treatment	10.3	Navigate 2,4-D granular	100 lb/ac	good
November 1	Eurasian watermilfoil treatment	29.15	Navigate, DMA-4 2,4-D Renovate 3 OTF, Reward	100 lb/ac, 6.5 gal/ac, 90 lbs/ac, 1 gal./ac	unknown
November 21	Permit meeting with LARE, Consultants, and District Fisheries Biologists				

Table 2 Aquatic Plant Management Activities in 2007

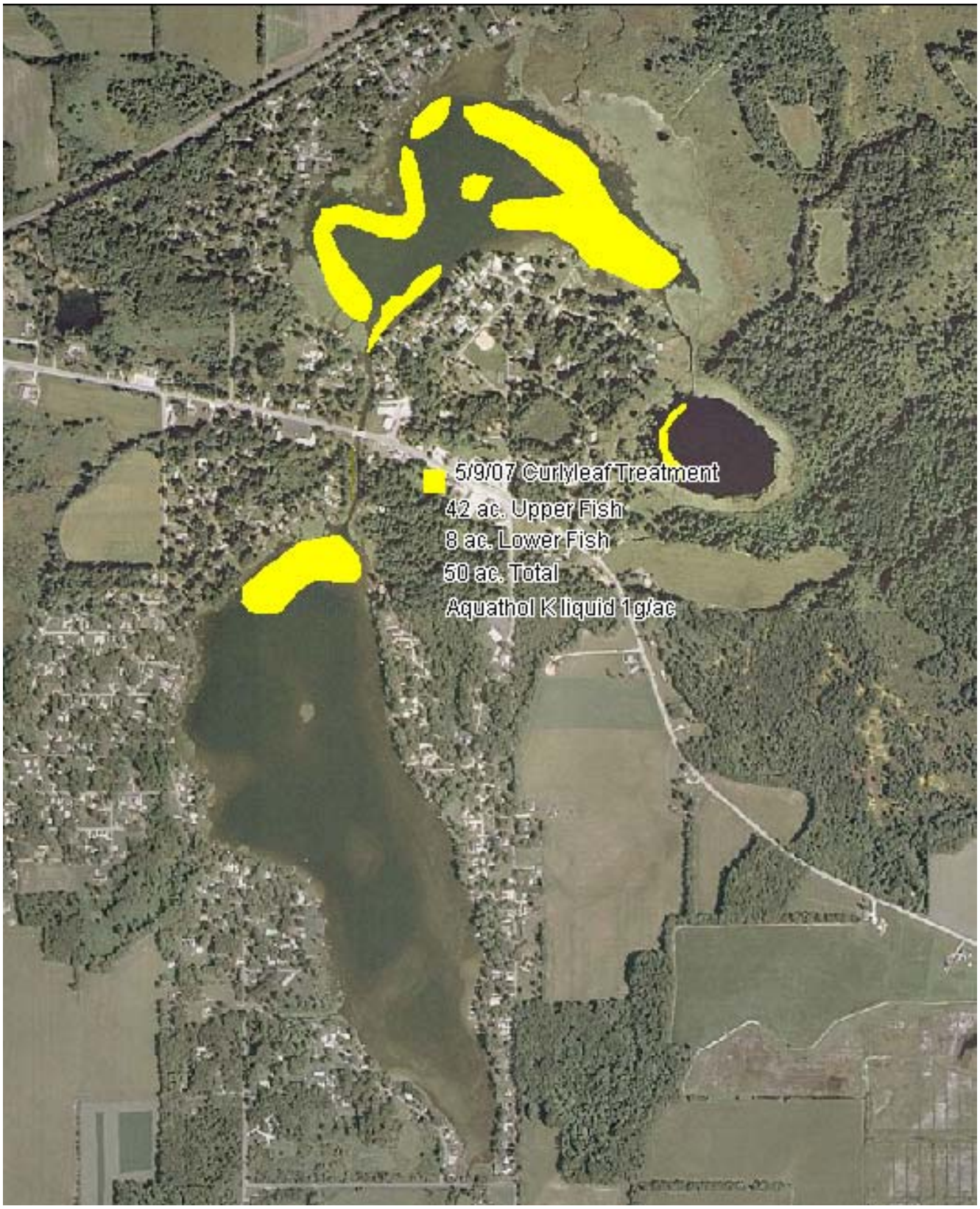


Figure 3 5/11/07 Curlyleaf pondweed treatment

Figure 4 5/22/07 Eurasian watermilfoil treatment

Figure 5 6/25 and 7/17/07 Filamentous Algae treatment areas

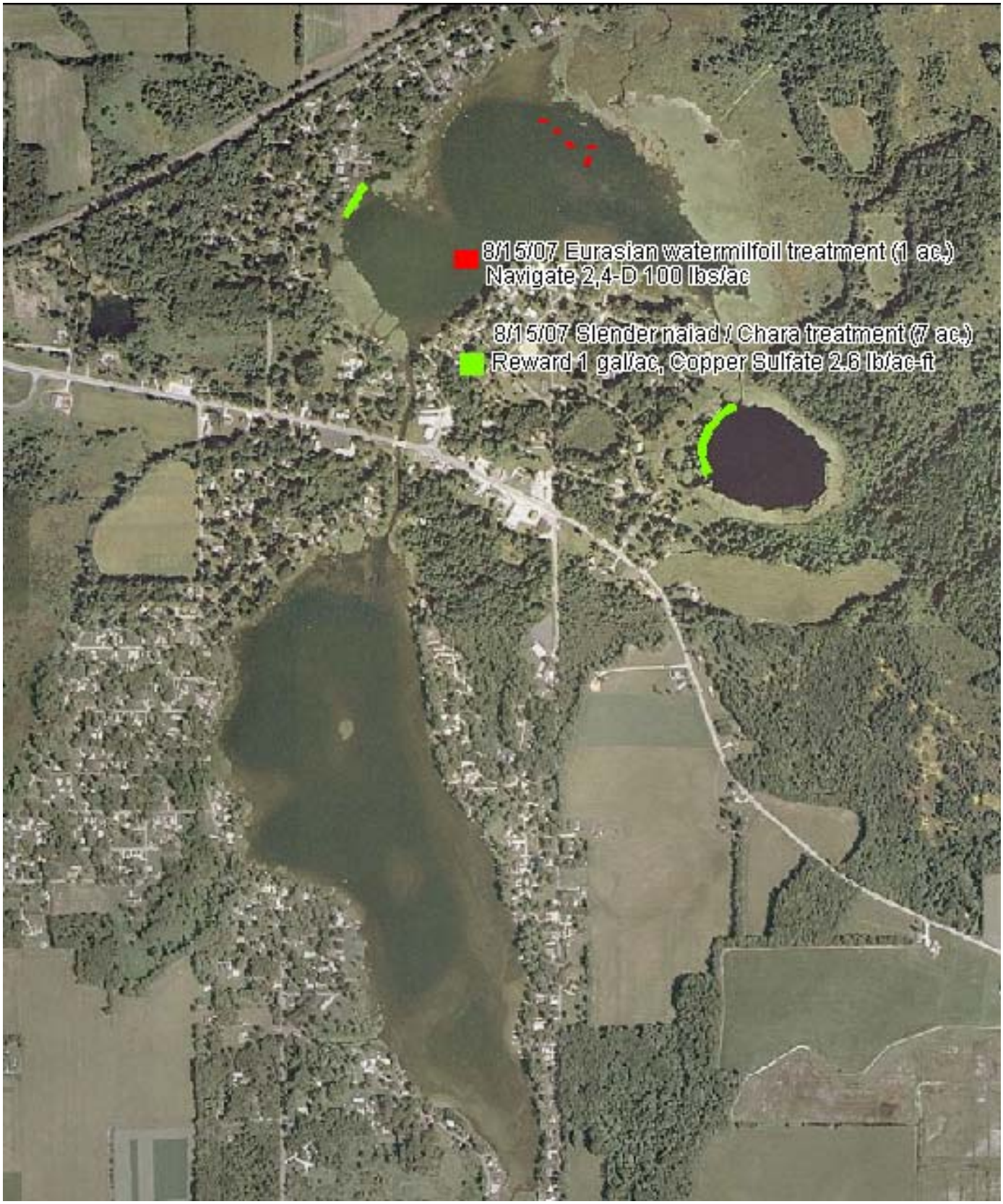


Figure 6 8/15/07 Eurasian watermilfoil, Slender naiad and Chara treatment

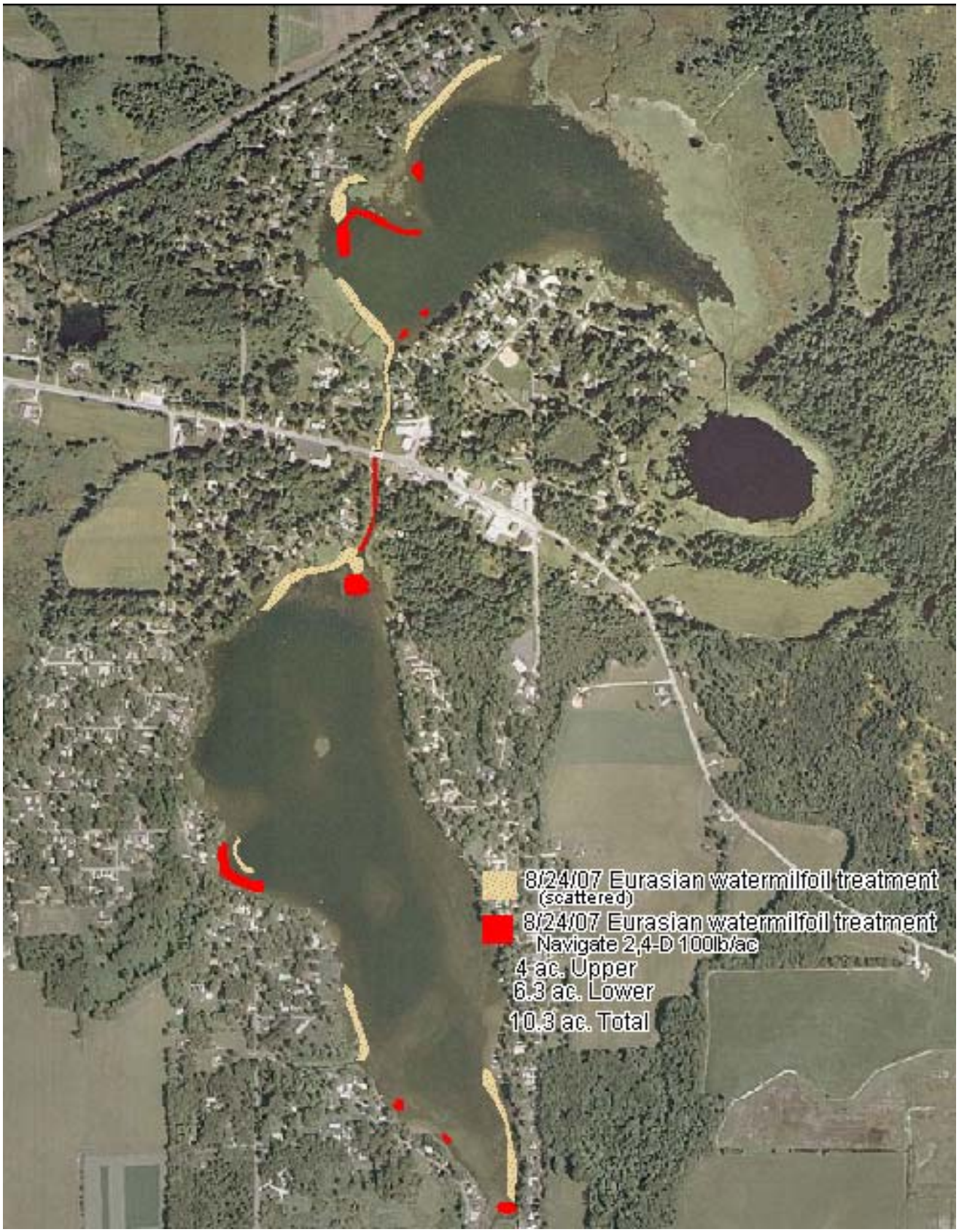


Figure 7 8/24/07 Eurasian watermilfoil treatment areas

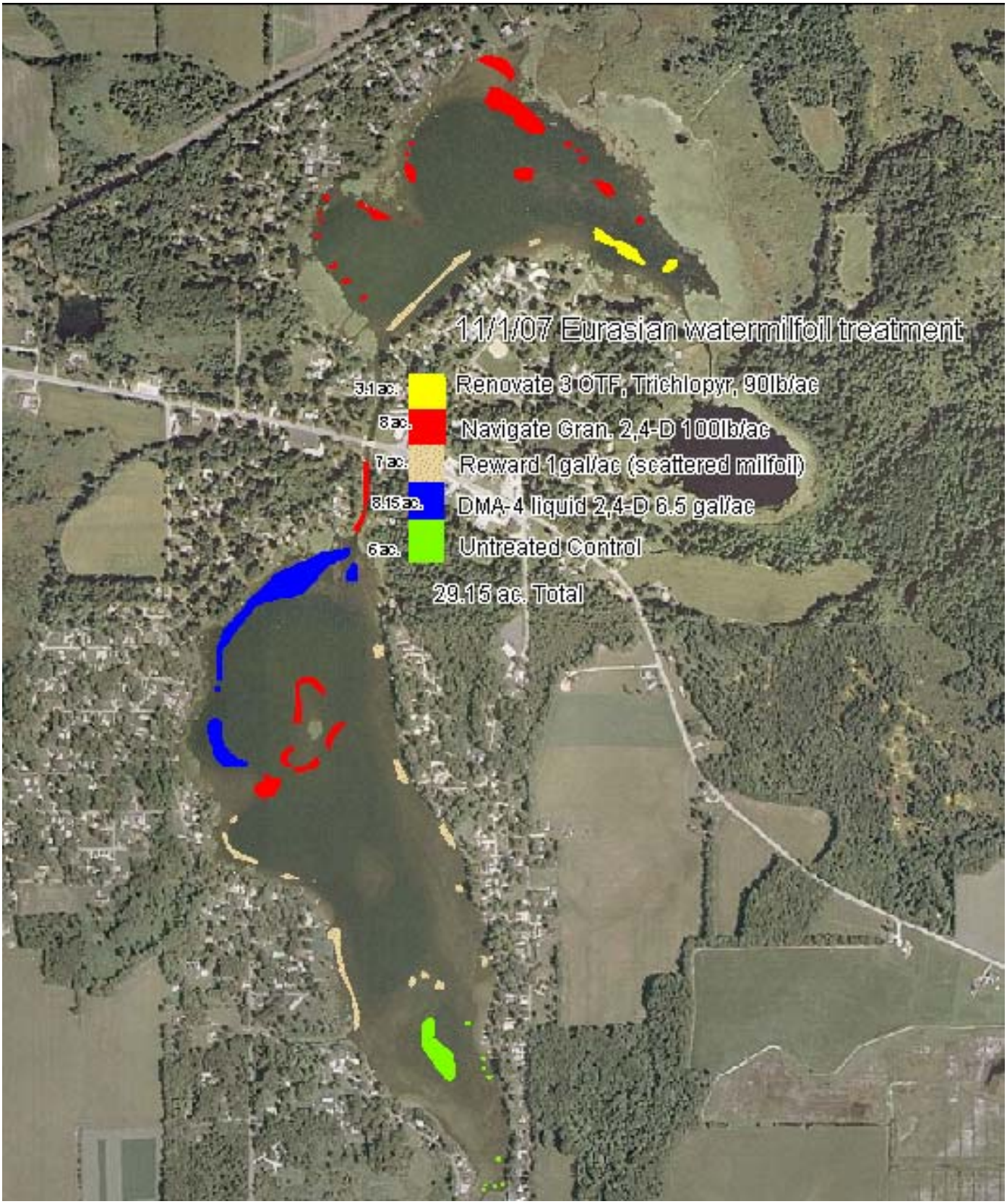


Figure 8 11/1/07 Experimental Eurasian watermilfoil treatment areas

8.0 Aquatic Plant Community Characterization

8.1 Methods

The aquatic plant sampling regime employed in 2007 was modified over the 2006 sampling. The sampling regime known as Tier I qualitative sampling, previously employed on each LARE managed lake was eliminated from the 2007 IDNR plant sampling protocol and thus no Tier I sampling was performed. As in 2006 a single Tier II plant survey was performed. For a description of the basic Tier II protocol see JF New 2006, 2007. Protocol modifications new in 2007 are detailed in the *Tier II Aquatic Vegetation Survey Protocol, May 2007* (IDNR 2007). Changes in 2007 included the categorization of rake scores as one, three, or five, rather than one through five as in the prior protocol. The trophic state classification published for Upper Fish Lake was changed from Mesotrophic to Oligotrophic. This would ordinarily require plant sampling to a depth of 25 feet. Based on the data from previous surveys the plant sampling was directed by IDNR to extend to 20 feet on both lakes. A decrease in sampling depth proved appropriate as plants (besides filamentous algae) only occurred to a depth of 10.5 feet in Upper Fish in 2007 and 13 feet in Lower Fish. In the past Tier II sampling had been performed at new points during each survey. New points were selected for the 2007 survey as well. Although the current 2007 IDNR Tier II sampling protocol document does not specify that sampling be performed at identical points from season to season, personal communications with IDNR in the fall of 2007 have indicated that sampling points should be identical to the extent possible from season to season. Season 2008 sampling should be performed at the 2007 season coordinates provided in the appendices of this document.

8.2 Results

8.2.1 Description of Beneficial and Problem Plant Areas

Upper Fish Lake

The general plant distribution and abundance in 2007 in Upper Fish was similar to 2006. Coontail and Chara were the most abundant species in both years. The colonization of the lake's bottom by exotic plants followed a similar pattern as in 2006 as well. Fewer submersed plant species were identified during the 2007 surveys than in 2006. This is primarily due to the loss of the Tier I survey in the new sampling protocol. Tier I surveys involve extensive visual identification of plant species in shallow areas of the lake while collection and identification of plants is more restricted in Tier II by the limited number and location of rake tosses. The 2006 season also included an earlier (June) pre-treatment plant survey that would have shown more early-season species such as Curlyleaf pondweed and species susceptible to control by the herbicide applications. Submersed and floating plants identified in the 2006 Tier I survey, but not in the 2007 Tier II survey include Elodea, Variable watermilfoil, Northern watermilfoil, Southern naiad, Berchtold's pondweed, Leafy pondweed, Illinois pondweed, Large duckweed, Water meal sp., Common duckweed, and Star duckweed.

The Tier II survey species list from 2006 was a relatively close match with the 2007 Tier II list. Twelve species of submersed plants were identified in the 2006 Tier II survey while 11 were identified during 2007. Species unique to the 2006 survey included Southern naiad, White water crow's foot, and Northern watermilfoil. Species unique to the 2007 Tier II Upper Fish list included Sago pondweed, Small pondweed, and Eurasian watermilfoil. Plants were found to a depth of 10.5 feet in 2007 compared to a 15 foot maximum plant depth in 2006. Because of aggressive treatment of exotic species during 2006 and 2007 the overall plant communities and littoral zone of Upper Fish during both years were dominated by beneficial native plants and should be considered beneficial areas.

Common Name	Scientific Name	IDNR Species Code	Year Sampled
Chara (a Chara species)	*Chara sp.*	CH	2006/2007
Small pondweed	*Potamogeton pusillus*	POTPUP	2006/2007
Variable pondweed	*Potamogeton gramineus*	POTGRA	2006/2007
Curlyleaf pondweed	***Potamogeton crispus***	**POTCRI**	**2006/2007**
Sago pondweed	*Stuckenia pectinata*	STUPEC	2006/2007
Coontail	*Ceratophyllum demersum*	CERDEM	2006/2007
Great bladderwort	*Utricularia macrorhiza*	UTRMAC	2006/2007
Creeping bladderwort	*Utricularia gibba*	UTRGIB	2006/2007
Vallisneria/Tapegrass/Eelgrass	*Vallisneria americana*	VALAME	2006/2007
Slender (Common) naiad	*Najas flexilis*	NAJFLE	2006/2007
Eurasian watermilfoil	***Myriophyllum spicatum***	**MYRSPI**	**2006/2007**
Elodea	*Elodea canadensis*	ELOCAN	2006
Variable watermilfoil	*Myriophyllum heterophyllum*	MYRHET	2006
Northern watermilfoil	*Myriophyllum exalbescens (also m. sibiricum)*	MYRSIB	2006
Southern naiad	*Najas guadalupensis*	NAJGUA	2006
Berchtold's pondweed	*Potamogeton berchtoldii*	POTBER	2006
Leafy pondweed	*Potamogeton foliosus*	POTFOL	2006
Illinois pondweed	*Potamogeton illinoiensis*	POTILL	2006
Large duckweed	*Spirodela polyrhiza*		2006
Watermeal sp.	*Wolffia sp*	WOA001	2006
Common duckweed	*Lemna minor*	LEMMIO	2006
Star duckweed	*Lemna trisulca*	LEMTRI	2006
White water crowfoot	*Ranunculus longirostris*	RANLON	2006

Table 3 Submersed plant species noted in the 2006 and 2007 Upper Fish Lake Surveys. Non-native species are in bold type.

Lower Fish Lake

The 2007 season general plant distribution and abundances were also similar to the 2006 season on Lower Fish Lake. Species dominance appears to have shifted somewhat, with Vallisneria being more prominent in the 2007 season. Chara and Variable pondweed were most abundant in the 2006 August 11 Tier II data, while Vallisneria and Chara were most abundant in the July 30, 2007 Tier II data. Whereas Vallisneria is a plant species of high food value to several migrating duck species, this is a beneficial development for wildlife. Because plant management activities were similar in 2006 and 2007 this shift is most likely due to unknown climatic variation, water quality changes, or reproductive cycling variability rather than an alteration in management practices. As in Upper Fish Lake fewer submersed plant species were identified during the 2007 surveys. In Lower Fish however, both the Tier I and Tier II surveys showed a significantly higher number of species than the 2007 Tier II.

Submersed and floating plants identified in the 2006 Tier I survey, but not in the 2007 Tier II survey include Elodea, Water stargrass, Northern watermilfoil, Spiny naiad, Curlyleaf pondweed, Leafy pondweed, Illinois pondweed, Berchtold's pondweed, Large duckweed, Common duckweed and Star duckweed. Eurasian watermilfoil was identified in the 2007 survey but didn't show up in either Tier I or Tier II data in 2006.

Figure 9 Vallisneria was abundant in 2007, spiral flower stalks were at the surface on much of Lower Fish Lake

The Tier II survey species list from 2006 showed 14 species while only 11 were identified during 2007. Species unique to the 2006 Tier II survey included Spiny naiad, Leafy pondweed, Illinois pondweed, Curlyleaf pondweed, and Northern watermilfoil. Species unique to the 2007 Tier II Lower Fish Lake data included Small pondweed, and Eurasian watermilfoil. Plants were found to a depth of 13 feet in 2007, down slightly from a 15 foot maximum plant depth in 2006. Because of aggressive treatment of exotic species during 2007 the overall plant community and littoral zone of Lower Fish was dominated by beneficial native plants and should be considered a beneficial area.

Common Name	**Scientific Name**	**IDNR Species Code**	**Year Sampled**
Chara (a Chara species)	*Chara sp.*	CH	2006/2007
Small pondweed	*Potamogeton pusillus*	POTPUP	2007
Variable pondweed	*Potamogeton gramineus*	POTGRA	2006/2007
Sago pondweed	*Stuckenia pectinata*	STUPEC	2006/2007
Coontail	*Ceratophyllum demersum*	CERDEM	2006/2007
Great bladderwort	*Utricularia macrorhiza*	UTRMAC	2006/2007
Southern naiad	*Najas guadalupensis*	NAJGUA	2006/2007
Vallisneria/Tapegrass/Eelgrass	*Vallisneria americana*	VALAME	2006/2007
Slender (Common) naiad	*Najas flexilis*	NAJFLE	2006/2007
Eurasian watermilfoil	***Myriophyllum spicatum***	**MYRSPI**	**2007**
Variable watermilfoil	*Myriophyllum heterophylum*	MYRHET	2006/2007
Curlyleaf pondweed	***Potamogeton crispus***	**POTCRI**	**2006**
Spiny naiad	*Najas marina*	NAJMAR	2006
Leafy pondweed	*Potamogeton foliosus*	POTFOL	2006
Illinois pondweed	*Potamogeton Illinoensis*	POTILL	2006

Common Name	Scientific Name	IDNR Species Code	Year Sampled
Northern watermilfoil	*Myriophyllum exalbescens (also m. sibiricum)*	MYRSIB	2006
Elodea	*Elodea canadensis*		2006
Water stargrass	*Zosterella dubia (also heteranthera dubia)*	ZOSDUB	2006
Berchtold's pondweed	*Potamogeton berchtoldii*	POTBER	2006
Common duckweed	*Lemna minor*	LEMMIO	2006
Star duckweed	*Lemna trisulca*	LEMTRI	2006

Table 4 Submersed plant species noted in the 2006, 2007 Lower Fish Lake surveys. Non-native species are in bold type.

8.2.2 Tier II

A Tier II Aquatic Plant Survey was conducted on Upper and Lower Fish Lake on 7/30/07. Rake tosses were performed at 40 sampling points on each of the two lakes. The sampling points are displayed on Figures 10 and 11 below. A set of statistical descriptors were calculated from the data to help characterize the lakes' plant communities and allow comparisons with other Indiana Lakes and prior season data (tables 15 and 16 below). Descriptors calculated are based on Pearson 2004. A set of descriptors is calculated for each depth contour (0-5 ft, 5-10 ft, 10-15 ft, and 15-20 ft) Results are displayed in tables 5-14 below.

Descriptor	Survey Post Treat 7/30/07	range for 21 other Indiana lakes	mean for 21 other Indiana lakes
# Sampling sites	**40**		
Total number of species	**11**	**1 to 17**	**8**
Total number of native species	**9**	**1 to 16**	**7**
Mean number of species per site	**1.45**	**.38 to 2.66**	**1.61**
Species diversity index (SDI), 0-1 scale,	**.82**	**0.0 to .91**	**0.66**

Table 5 Descriptor Comparisons for Upper Fish Lake

Descriptor	Survey Post Treat 7/30/07	range for 21 other Indiana lakes	mean for 21 other Indiana lakes
# Sampling sites	40		
Total number of species	11	1 to 17	8
Total number of native species	10	1 to 16	7
Mean number of species per site	1.75	.38 to 2.66	1.61
Species diversity index (SDI), 0-1 scale,	.86	0.0 to .91	0.66

Table 6 Descriptor Comparisons for Lower Fish Lake

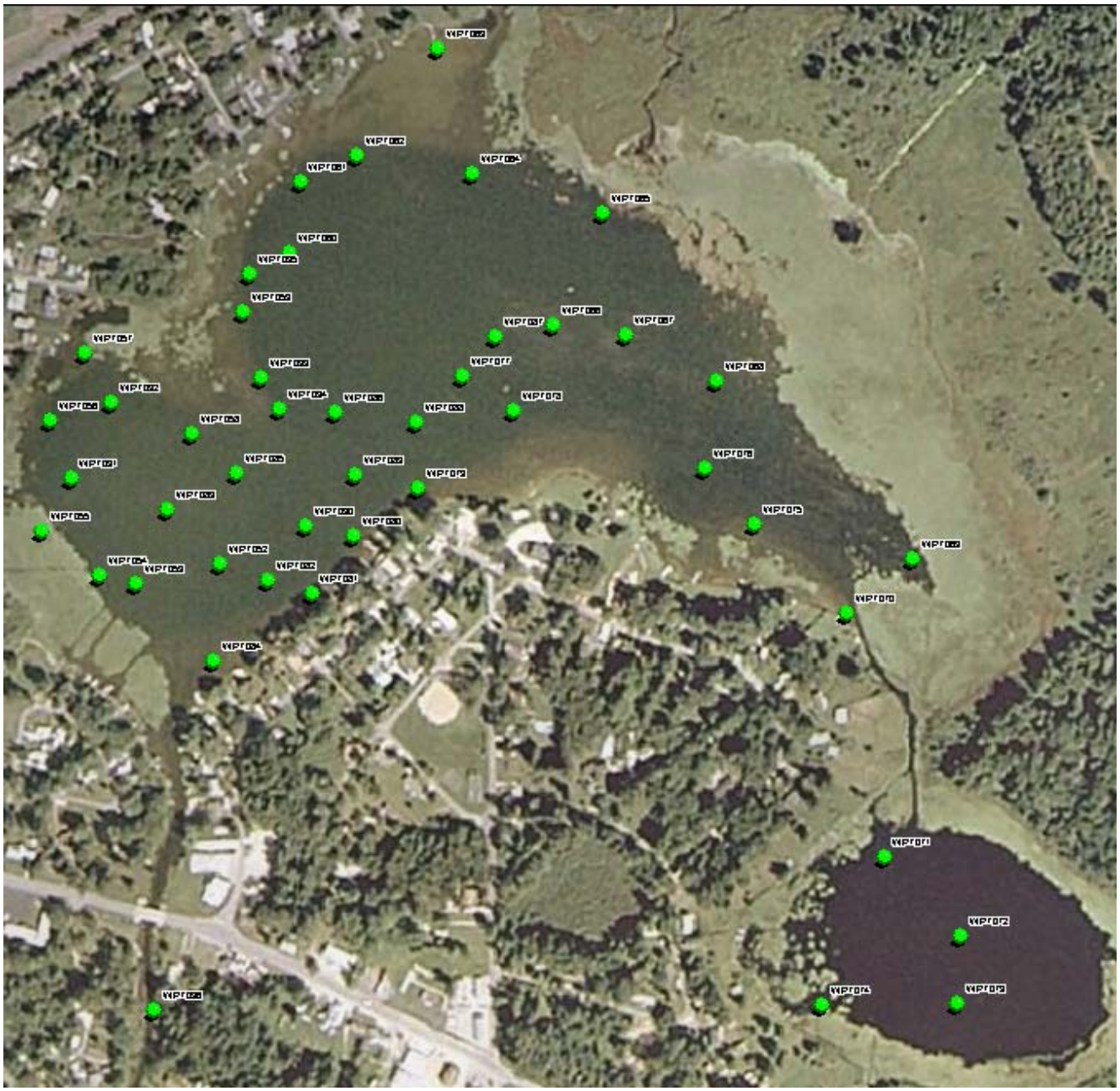


Figure 10 July 30, 2007 Tier II Survey Sampling Points For Upper Fish/ Mud Lake

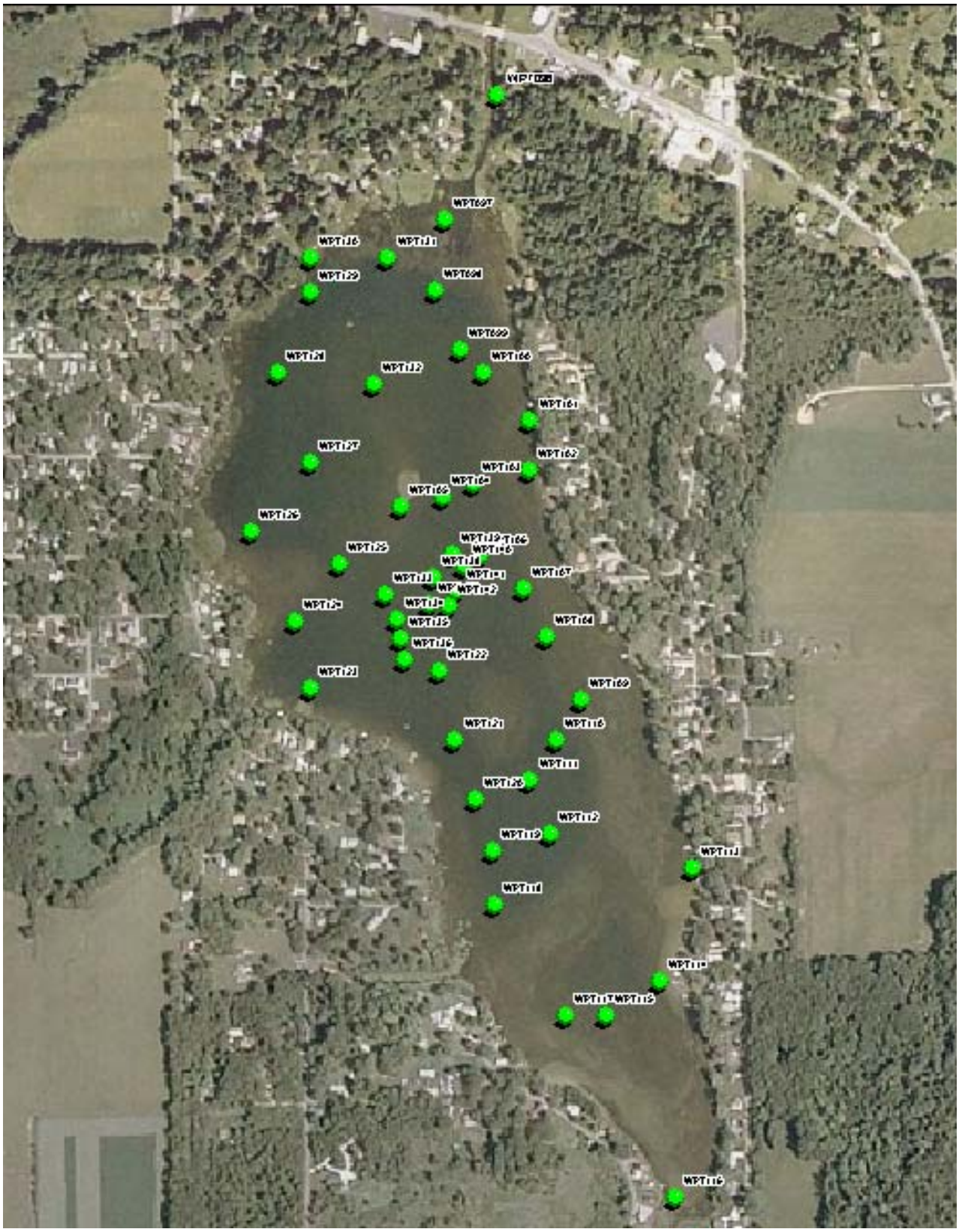


Figure 11 July 30, 2007 Tier II Sampling Points for Lower Fish Lake

Occurrence and Abundance of Submersed Aquatic Plants - Overall								
Lake: Upper Fish (LaPorte)			Secchi(ft): 5.0			SE Mean species / site: 0.28		
Date: 7'30/07			Littoral sites with plants: 23			Mean natives / site: 1.40		
Littoral Depth (ft): 13.0			Number of species: 11			SE Mean natives / site: 0.27		
Littoral Sites: 29			Maximum species / site: 6			Species diversity: 0.82		
Total Sites: 40			Mean species / site: 1.45			Native diversity: 0.81		
		Frequency of		**Score Frequency**				
Species		**Occurrence**		**0**	**1**	**3**	**5**	**Dominance**
CERDEM Coontail		47.5		52.5	27.5	7.5	12.5	22.5
CHAR Chara		22.5		77.5	7.5	0.0	15.0	16.5
NAJFLE Slender naiad		17.5		82.5	12.5	2.5	2.5	6.5
VALAME Vallisneria		17.5		82.5	12.5	2.5	2.5	6.5
STUPEC Sago pondweed		12.5		87.5	10.0	2.5	0.0	3.5
UTRMAC Great Bladderwort		12.5		87.5	12.5	0.0	0.0	2.5
POTPUS Small pondweed		5.0		95.0	5.0	0.0	0.0	1.0
MYRSPI Eurasian milfoil		2.5		97.5	2.5	0.0	0.0	0.5
POT CRI Curlyleaf pondweed		2.5		97.5	2.5	0.0	0.0	0.5
POTGRA Variable pondweed		2.5		97.5	2.5	0.0	0.0	0.5
UTRGIB Creeping Bladderwort		2.5		97.5	2.5	0.0	0.0	0.5
Filamentous Algae		5.0						

Table 7 7/30/07 Tier II data for Upper Fish Lake, All Contours

Occurrence and Abundance of Submersed Aquatic Plants - 0 to 5 ft.								
Lake: Upper Fish (LaPorte)			Secchi(ft): 5.0			SE Mean species / site: 0.49		
Date: 7'30/07			Littoral sites with plants: 10			Mean natives / site: 3.70		
Littoral Depth (ft): 13.0			Number of species: 10			SE Mean natives / site: 0.45		
Littoral Sites: 10			Maximum species / site: 6			Species diversity: 0.86		
Total Sites: 10			Mean species / site: 3.80			Native diversity: 0.85		
		Frequency of		**Score Frequency**				
Species		**Occurrence**		**0**	**1**	**3**	**5**	**Dominance**
CHAR Chara		80.0		20.0	20.0	0.0	60.0	64.0
NAJFLE Slender naiad		60.0		40.0	40.0	10.0	10.0	24.0
CERDEM Coontail		60.0		40.0	40.0	20.0	0.0	20.0
VALAME Vallisneria		60.0		40.0	50.0	0.0	10.0	20.0
STUPEC Sago pondweed		40.0		60.0	30.0	10.0	0.0	12.0
UTRMAC Great Bladderwort		30.0		70.0	30.0	0.0	0.0	6.0
POTPUS Small pondweed		20.0		80.0	20.0	0.0	0.0	4.0
MYRSPI Eurasian milfoil		10.0		90.0	10.0	0.0	0.0	2.0
POTGRA Variable pondweed		10.0		90.0	10.0	0.0	0.0	2.0
UTRGIB Creeping Bladderwort		10.0		90.0	10.0	0.0	0.0	2.0
POT CRI Curlyleaf pondweed		0.0		100.0	0.0	0.0	0.0	0.0
Filamentous Algae		10.0						

Table 8 7/30/07 Tier II data for Upper Fish Lake, 0-5 ft Contour

Occurrence and Abundance of Submersed Aquatic Plants - 5 to 10 ft.

Lake: Upper Fish (LaPorte)	Secchi(ft): 5.0	SE Mean species / site: 0.37
Date: 7'30/07	Littoral sites with plants: 9	Mean natives / site: 1.50
Littoral Depth (ft): 13.0	Number of species: 7	SE Mean natives / site: 0.37
Littoral Sites: 10	Maximum species / site: 4	Species diversity: 0.65
Total Sites: 10	Mean species / site: 1.60	Native diversity: 0.60

	Frequency of	Score Frequency				
Species	**Occurrence**	**0**	**1**	**3**	**5**	**Dominance**
CERDEM Coontail	90.0	10.0	40.0	10.0	40.0	54.0
UTRMAC Great Bladderwort	20.0	80.0	20.0	0.0	0.0	4.0
VALAME Vallisneria	10.0	90.0	0.0	10.0	0.0	6.0
CHAR Chara	10.0	90.0	10.0	0.0	0.0	2.0
NAJFLE Slender naiad	10.0	90.0	10.0	0.0	0.0	2.0
POT CRI Curlyleaf pondweed	10.0	90.0	10.0	0.0	0.0	2.0
STUPEC Sago pondweed	10.0	90.0	10.0	0.0	0.0	2.0
MYRSPI Eurasian milfoil	0.0	100.0	0.0	0.0	0.0	0.0
POTGRA Variable pondweed	0.0	100.0	0.0	0.0	0.0	0.0
POTPUS Small pondweed	0.0	100.0	0.0	0.0	0.0	0.0
UTRGIB Creeping Bladderwort	0.0	100.0	0.0	0.0	0.0	0.0
Filamentous Algae	10.0					

Table 9 7/30/07 Tier II Data for Upper Fish Lake, 5-10 ft Contour

Occurrence and Abundance of Submersed Aquatic Plants - 10 to 15 ft.

Lake: Upper Fish (LaPorte)	Secchi(ft): 5.0	SE Mean species / site: 0.15
Date: 7'30/07	Littoral sites with plants: 3	Mean natives / site: 0.30
Littoral Depth (ft): 13.0	Number of species: 1	SE Mean natives / site: 0.15
Littoral Sites: 8	Maximum species / site: 1	Species diversity: 0.00
Total Sites: 10	Mean species / site: 0.30	Native diversity: 0.00

	Frequency of	Score Frequency				
Species	**Occurrence**	**0**	**1**	**3**	**5**	**Dominance**
CERDEM Coontail	30.0	70.0	20.0	0.0	10.0	14.0
CHAR Chara	0.0	100.0	0.0	0.0	0.0	0.0
MYRSPI Eurasian milfoil	0.0	100.0	0.0	0.0	0.0	0.0
NAJFLE Slender naiad	0.0	100.0	0.0	0.0	0.0	0.0
POT CRI Curlyleaf pondweed	0.0	100.0	0.0	0.0	0.0	0.0
POTGRA Variable pondweed	0.0	100.0	0.0	0.0	0.0	0.0
POTPUS Small pondweed	0.0	100.0	0.0	0.0	0.0	0.0
STUPEC Sago pondweed	0.0	100.0	0.0	0.0	0.0	0.0
UTRGIB Creeping Bladderwort	0.0	100.0	0.0	0.0	0.0	0.0
UTRMAC Great Bladderwort	0.0	100.0	0.0	0.0	0.0	0.0
VALAME Vallisneria	0.0	100.0	0.0	0.0	0.0	0.0
Filamentous Algae	0.0					

Table 10 7/30/07 Tier II Data for Upper Fish Lake, 10-15 ft contour

Occurrence and Abundance of Submersed Aquatic Plants - 15 to 20 ft.

Lake: Upper Fish (LaPorte)	Secchi(ft): 5.0	SE Mean species / site: 0.10
Date: 7'30/07	Littoral sites with plants: 1	Mean natives / site: 0.10
Littoral Depth (ft): 13.0	Number of species: 1	SE Mean natives / site: 0.10
Littoral Sites: 0	Maximum species / site: 1	Species diversity: 0.00
Total Sites: 10	Mean species / site: 0.10	Native diversity: 0.00

		Frequency of		Score Frequency				
Species		**Occurrence**		**0**	**1**	**3**	**5**	**Dominance**
CERDEM Coontail		10.0		90.0	10.0	0.0	0.0	2.0
CHAR Chara		0.0		100.0	0.0	0.0	0.0	0.0
MYRSPI Eurasian milfoil		0.0		100.0	0.0	0.0	0.0	0.0
NAJFLE Slender naiad		0.0		100.0	0.0	0.0	0.0	0.0
POT CRI Curlyleaf pondweed		0.0		100.0	0.0	0.0	0.0	0.0
POTGRA Variable pondweed		0.0		100.0	0.0	0.0	0.0	0.0
POTPUS Small pondweed		0.0		100.0	0.0	0.0	0.0	0.0
STUPEC Sago pondweed		0.0		100.0	0.0	0.0	0.0	0.0
UTRGIB Creeping Bladderwort		0.0		100.0	0.0	0.0	0.0	0.0
UTRMAC Great Bladderwort		0.0		100.0	0.0	0.0	0.0	0.0
VALAME Vallisneria		0.0		100.0	0.0	0.0	0.0	0.0
Filamentous Algae		0.0						

Table 11 7/30/07 Tier II Data for Upper Fish Lake, 15-20 Foot Contour

Occurrence and Abundance of Submersed Aquatic Plants - Overall

Lake: Lower Fish (Laporte)	Secchi(ft): 5.0	SE Mean species / site: 0.31
Date: 7/10/2007	Littoral sites with plants: 24	Mean natives / site: 1.63
Littoral Depth (ft): 13.0	Number of species: 11	SE Mean natives / site: 0.29
Littoral Sites: 29	Maximum species / site: 7	Species diversity: 0.86
Total Sites: 40	Mean species / site: 1.75	Native diversity: 0.84

VALAME Vallisneria		40.0		60.0	27.5	7.5	5.0	15.0
CHAR Chara		27.5		72.5	12.5	2.5	12.5	16.5
NAJGUA Southern naiad		27.5		72.5	17.5	2.5	7.5	12.5
CERDEM Coontail		22.5		77.5	15.0	2.5	5.0	9.5
NAJFLE Slender naiad		17.5		82.5	17.5	0.0	0.0	3.5
MYRSPI Eurasian milfoil		12.5		87.5	12.5	0.0	0.0	2.5
POTGRA Variable pondweed		10.0		90.0	10.0	0.0	0.0	2.0
UTRMAC Great Bladderwort		7.5		92.5	7.5	0.0	0.0	1.5
STUPEC Sago pondweed		5.0		95.0	5.0	0.0	0.0	1.0
MYRHET Variable watermilfoil		2.5		97.5	2.5	0.0	0.0	0.5
POTPUD Small pondweed		2.5		97.5	2.5	0.0	0.0	0.5
Filamentous Algae		10.0						

Table 12 7/30/07 Tier II Data for Lower Fish Lake, All Contours

Occurrence and Abundance of Submersed Aquatic Plants - 0 to 5 ft.								
Lake: Lower Fish (Laporte)			Secchi(ft): 5.0		SE Mean species / site: 0.74			
Date: 7/10/2007		Littoral sites with plants: 8			Mean natives / site: 2.90			
Littoral Depth (ft): 13.0		Number of species: 9			SE Mean natives / site: 0.69			
Littoral Sites: 10		Maximum species / site: 7			Species diversity: 0.88			
Total Sites: 10		Mean species / site: 3.20			Native diversity: 0.86			
VALAME Vallisneria		60.0		40.0	30.0	10.0	20.0	32.0
NAJGUA Southern naiad		50.0		50.0	30.0	10.0	10.0	22.0
CHAR Chara		40.0		60.0	20.0	0.0	20.0	24.0
NAJFLE Slender naiad		40.0		60.0	40.0	0.0	0.0	8.0
CERDEM Coontail		30.0		70.0	30.0	0.0	0.0	6.0
MYRSPI Eurasian milfoil		30.0		70.0	30.0	0.0	0.0	6.0
POTGRA Variable pondweed		30.0		70.0	30.0	0.0	0.0	6.0
STUPEC Sago pondweed		20.0		80.0	20.0	0.0	0.0	4.0
UTRMAC Great Bladderwort		20.0		80.0	20.0	0.0	0.0	4.0
MYRHET Variable watermilfoil		0.0		100.0	0.0	0.0	0.0	0.0
POTPUD Small pondweed		0.0		100.0	0.0	0.0	0.0	0.0
Filamentous Algae		10.0						

Table 13 7/30/07 Tier II Survey Data for Lower Fish Lake, 0-5 ft Contour

Occurrence and Abundance of Submersed Aquatic Plants - 5 to 10 ft.								
Lake: Lower Fish (Laporte)			Secchi(ft): 5.0		SE Mean species / site: 0.44			
Date: 7/10/2007		Littoral sites with plants: 8			Mean natives / site: 2.00			
Littoral Depth (ft): 13.0		Number of species: 7			SE Mean natives / site: 0.39			
Littoral Sites: 10		Maximum species / site: 4			Species diversity: 0.83			
Total Sites: 10		Mean species / site: 2.20			Native diversity: 0.80			
CHAR Chara		50.0		50.0	20.0	10.0	20.0	30.0
VALAME Vallisneria		50.0		50.0	30.0	20.0	0.0	18.0
NAJGUA Southern naiad		40.0		60.0	20.0	0.0	20.0	24.0
CERDEM Coontail		30.0		70.0	0.0	10.0	20.0	26.0
MYRSPI Eurasian milfoil		20.0		80.0	20.0	0.0	0.0	4.0
NAJFLE Slender naiad		20.0		80.0	20.0	0.0	0.0	4.0
POTPUD Small pondweed		10.0		90.0	10.0	0.0	0.0	2.0
MYRHET Variable watermilfoil		0.0		100.0	0.0	0.0	0.0	0.0
POTGRA Variable pondweed		0.0		100.0	0.0	0.0	0.0	0.0
STUPEC Sago pondweed		0.0		100.0	0.0	0.0	0.0	0.0
UTRMAC Great Bladderwort		0.0		100.0	0.0	0.0	0.0	0.0
Filamentous Algae		0.0						

Table 14 7/30/07 Tier II Survey Data for Lower Fish Lake, 5-10 ft Contour

Occurrence and Abundance of Submersed Aquatic Plants - 10 to 15 ft.								
Lake: Lower Fish (Laporte)			Secchi(ft): 5.0		SE Mean species / site: 0.54			
Date: 7/10/2007		Littoral sites with plants: 8			Mean natives / site: 1.60			
Littoral Depth (ft): 13.0		Number of species: 8			SE Mean natives / site: 0.54			
Littoral Sites: 9		Maximum species / site: 6			Species diversity: 0.82			
Total Sites: 10		Mean species / site: 1.60			Native diversity: 0.82			
VALAME Vallisneria		50.0		50.0	50.0	0.0	0.0	10.0
CERDEM Coontail		30.0		70.0	30.0	0.0	0.0	6.0
CHAR Chara		20.0		80.0	10.0	0.0	10.0	12.0
NAJGUA Southern naiad		20.0		80.0	20.0	0.0	0.0	4.0
MYRHET Variable watermilfoil		10.0		90.0	10.0	0.0	0.0	2.0
NAJFLE Slender naiad		10.0		90.0	10.0	0.0	0.0	2.0
POTGRA Variable pondweed		10.0		90.0	10.0	0.0	0.0	2.0
UTRMAC Great Bladderwort		10.0		90.0	10.0	0.0	0.0	2.0
MYRSPI Eurasian milfoil		0.0		100.0	0.0	0.0	0.0	0.0
POTPUD Small pondweed		0.0		100.0	0.0	0.0	0.0	0.0
STUPEC Sago pondweed		0.0		100.0	0.0	0.0	0.0	0.0
Filamentous Algae		20.0						

Table 15 7/30/07 Tier II Survey Data for Lower Fish Lake, 10-15 ft Contour

Occurrence and Abundance of Submersed Aquatic Plants - 15 to 20 ft.								
Lake: Lower Fish (Laporte)			Secchi(ft): 5.0		SE Mean species / site: 0.00			
Date: 7/10/2007		Littoral sites with plants: 0			Mean natives / site: 0.00			
Littoral Depth (ft): 13.0		Number of species: 0			SE Mean natives / site: 0.00			
Littoral Sites: 0		Maximum species / site: 0			Species diversity: #DIV/0!			
Total Sites: 10		Mean species / site: 0.00			Native diversity: #DIV/0!			
CERDEM Coontail		0.0		100.0	0.0	0.0	0.0	0.0
CHAR Chara		0.0		100.0	0.0	0.0	0.0	0.0
MYRHET Variable watermilfoil		0.0		100.0	0.0	0.0	0.0	0.0
MYRSPI Eurasian milfoil		0.0		100.0	0.0	0.0	0.0	0.0
NAJFLE Slender naiad		0.0		100.0	0.0	0.0	0.0	0.0
NAJGUA Southern naiad		0.0		100.0	0.0	0.0	0.0	0.0
POTGRA Variable pondweed		0.0		100.0	0.0	0.0	0.0	0.0
POTPUD Small pondweed		0.0		100.0	0.0	0.0	0.0	0.0
STUPEC Sago pondweed		0.0		100.0	0.0	0.0	0.0	0.0
UTRMAC Great Bladderwort		0.0		100.0	0.0	0.0	0.0	0.0
VALAME Vallisneria		0.0		100.0	0.0	0.0	0.0	0.0
Filamentous Algae		10.0						

Table 16 7/30/07 Tier II Survey Data for Lower Fish Lake, 15-20 ft Contour

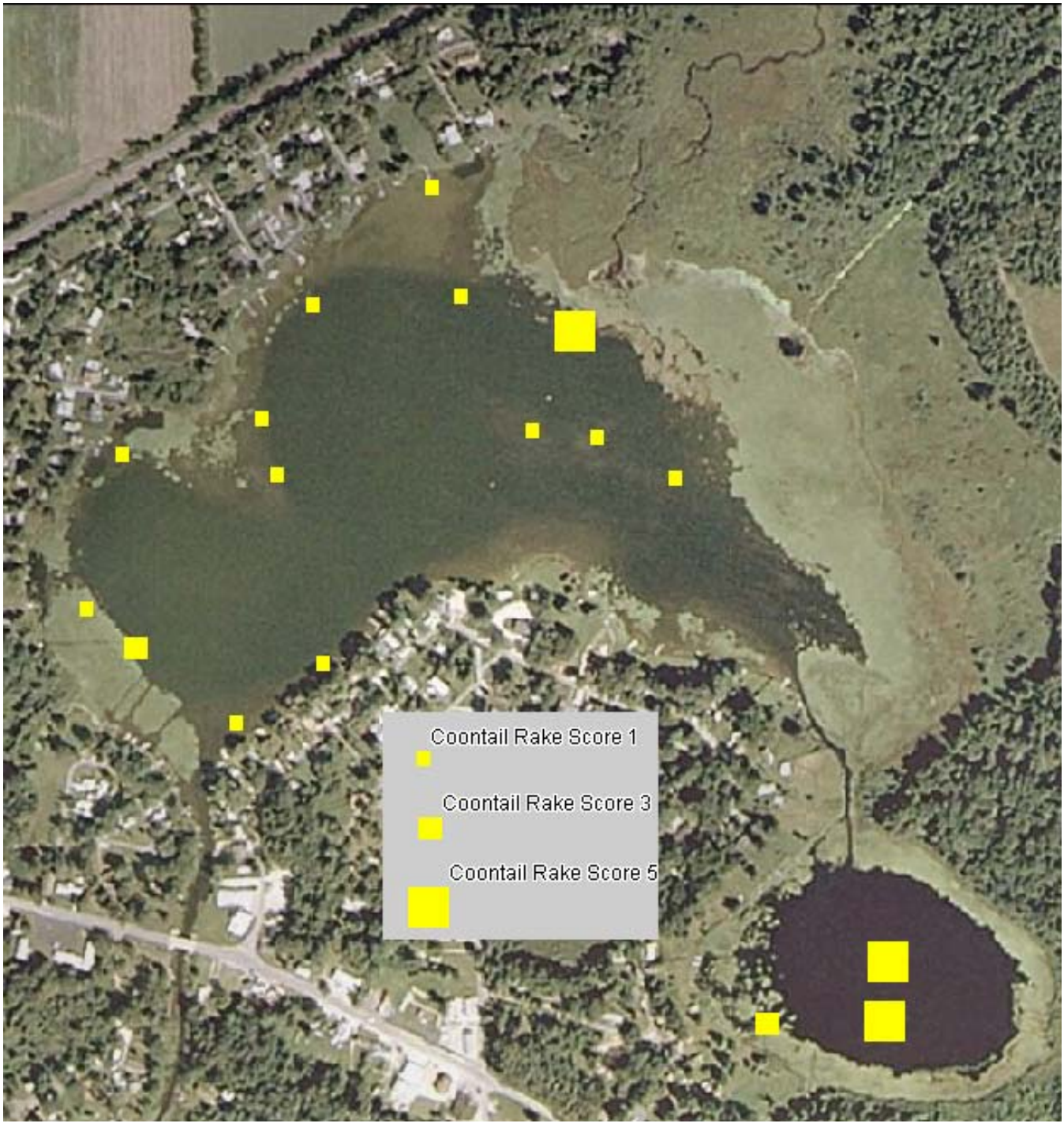


Figure 12 7/30/07 Coontail Map for Upper Fish Lake

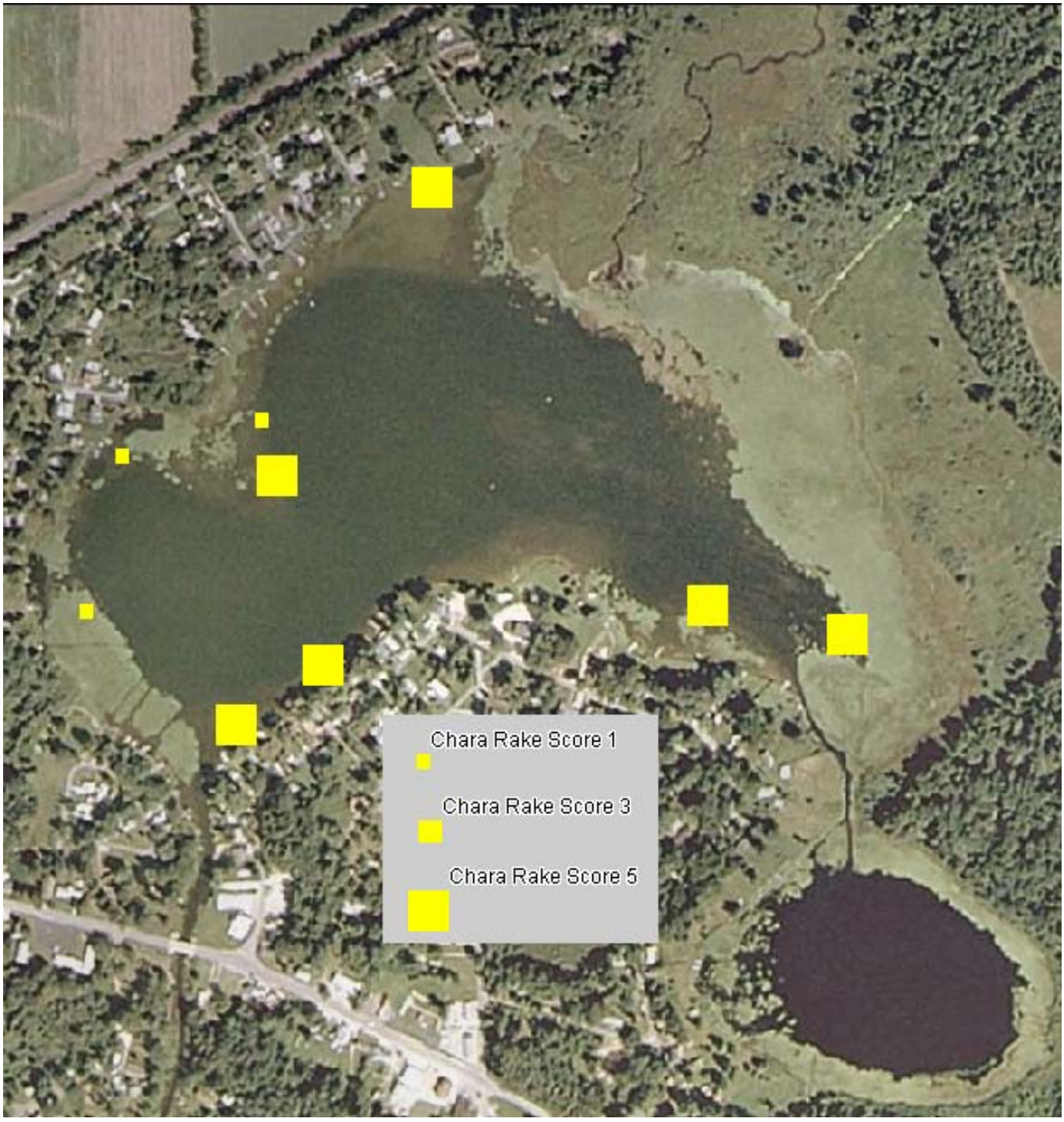


Figure 13 7/30/07 Chara Map for Upper Fish Lake

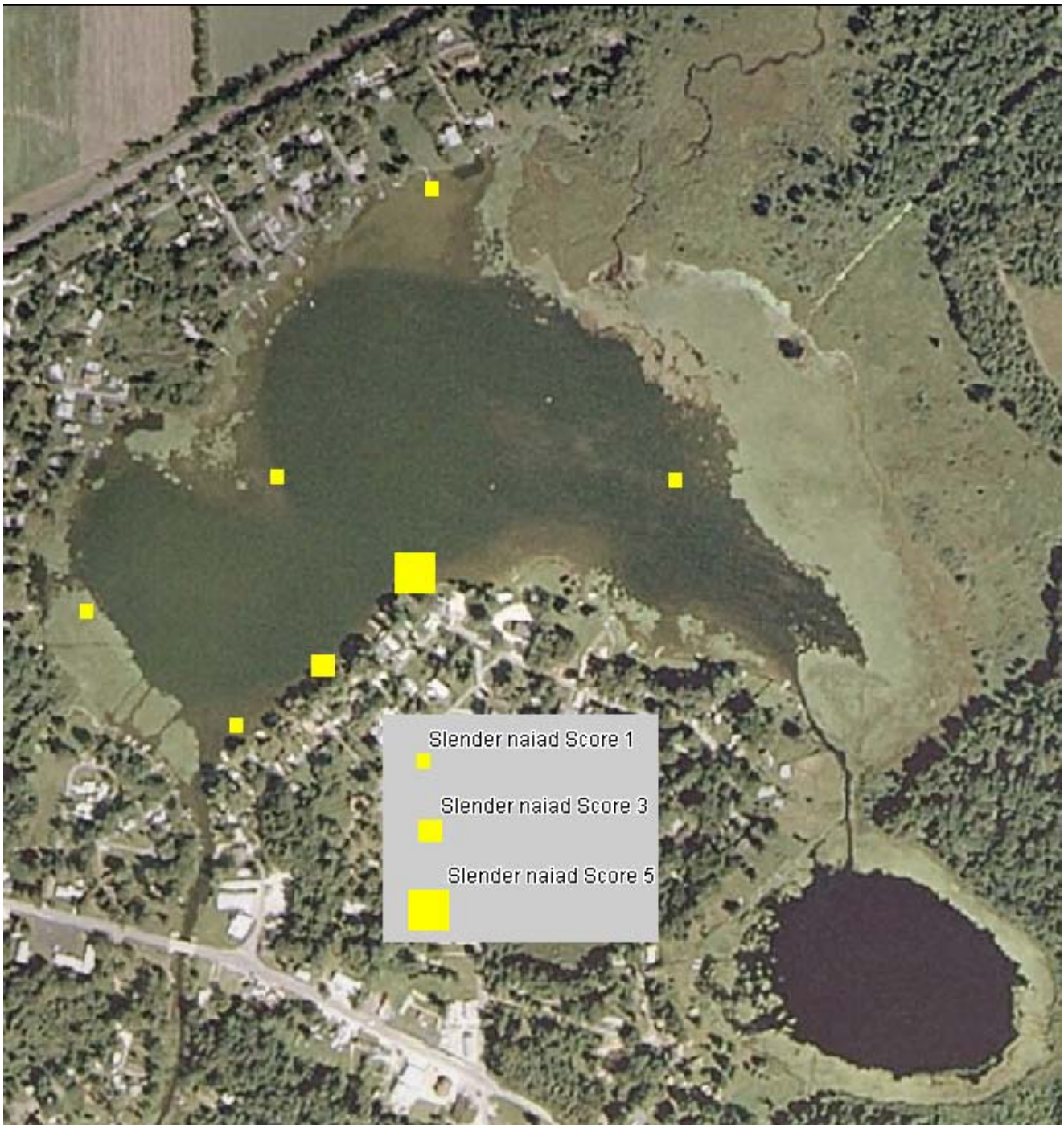


Figure 14 7/30/07 Slender naiad Map for Upper Fish Lake

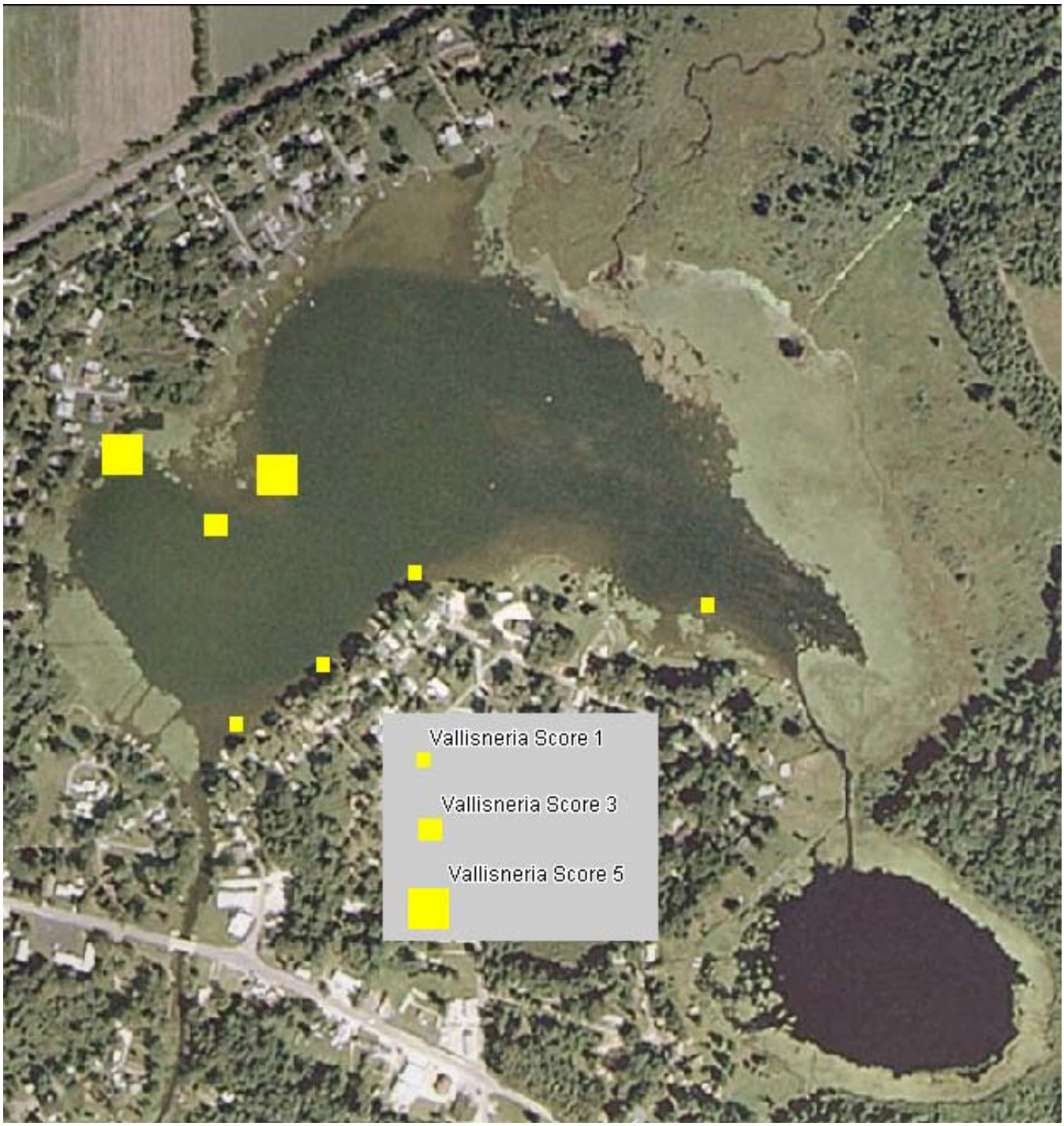


Figure 15 7/30/07 Vallisneria Map for Upper Fish Lake

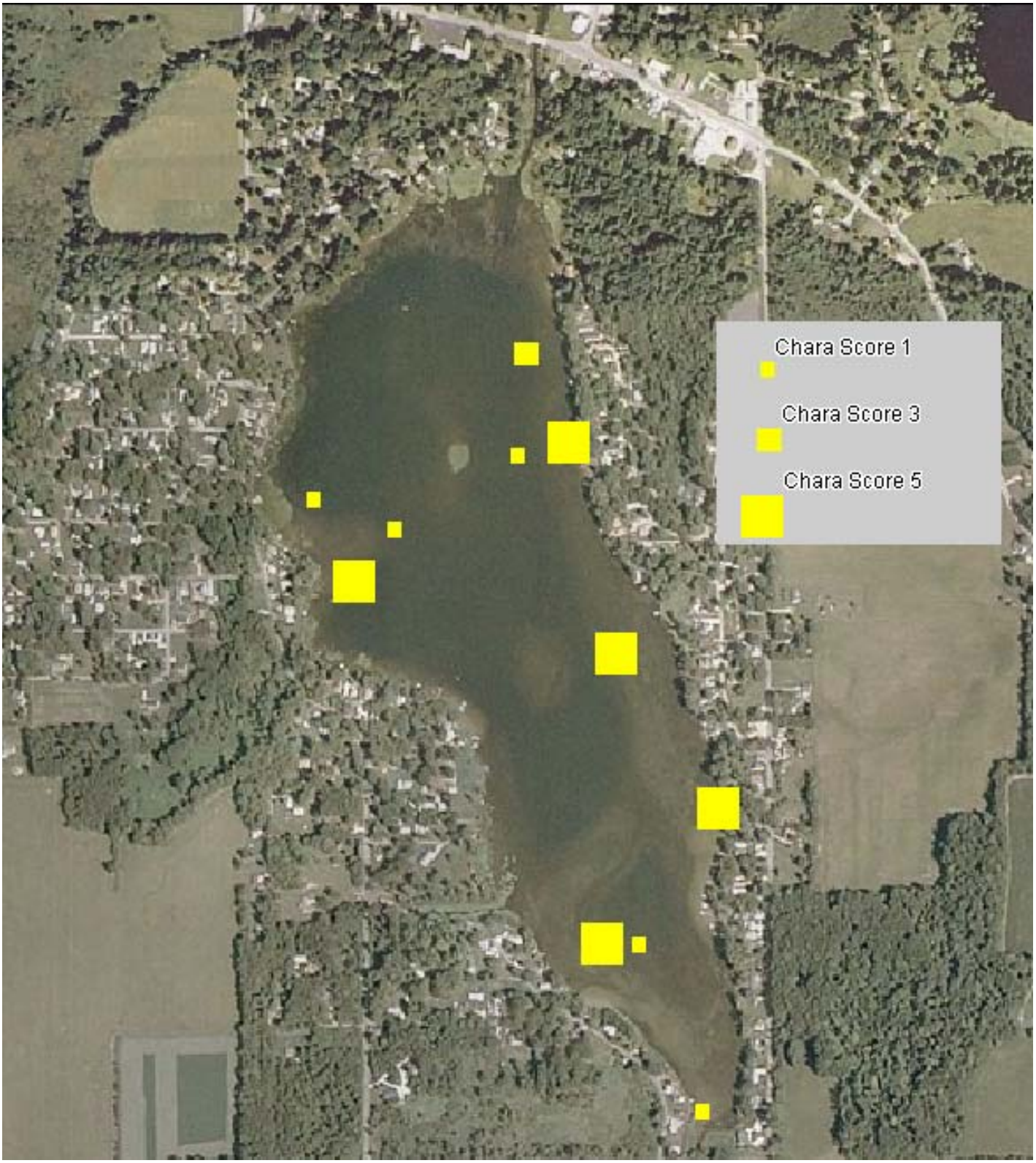


Figure 16 7/30/07 Chara Map for Lower Fish Lake

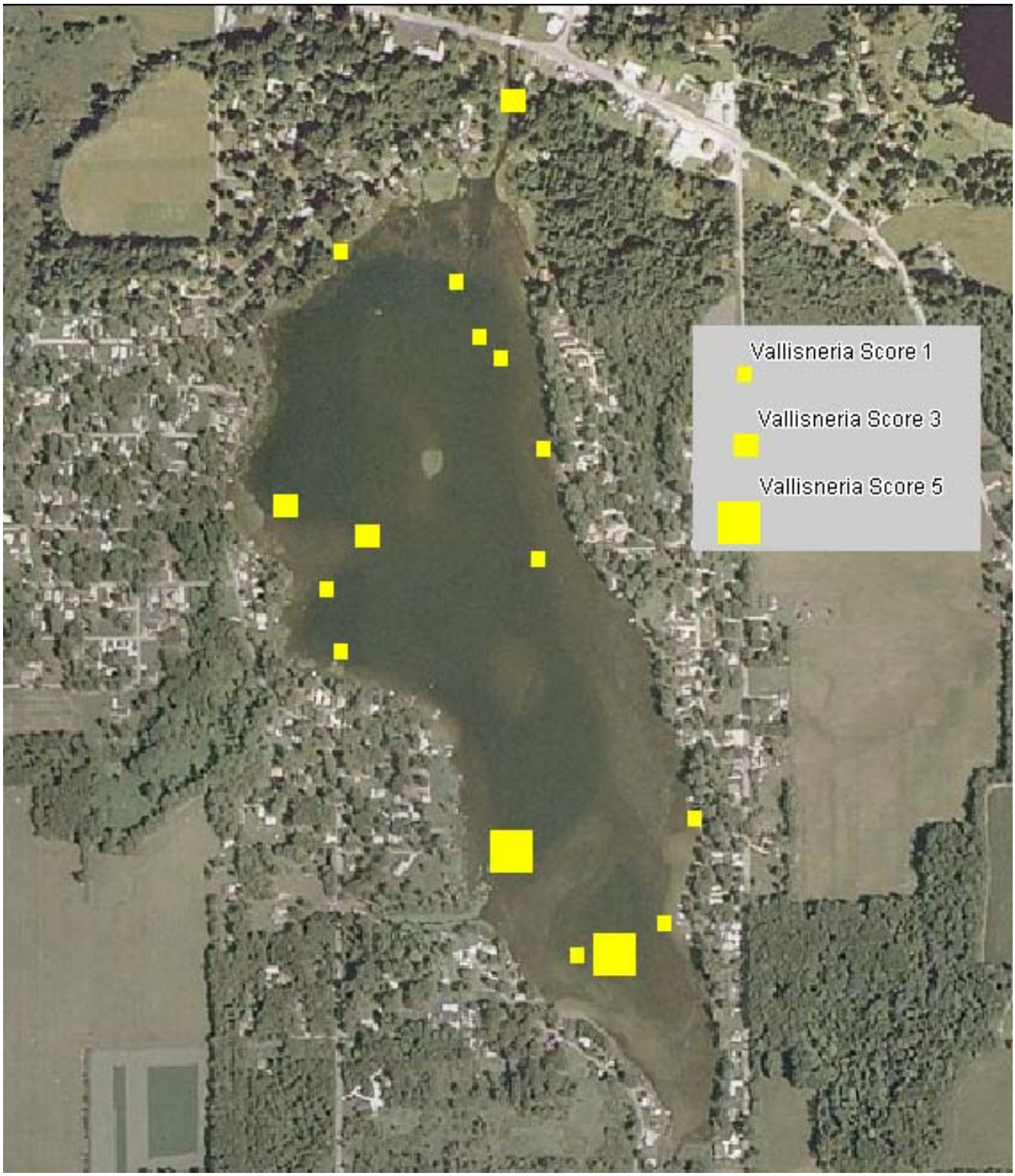


Figure 17 7/30/07 Vallisneria Map for Lower Fish Lake

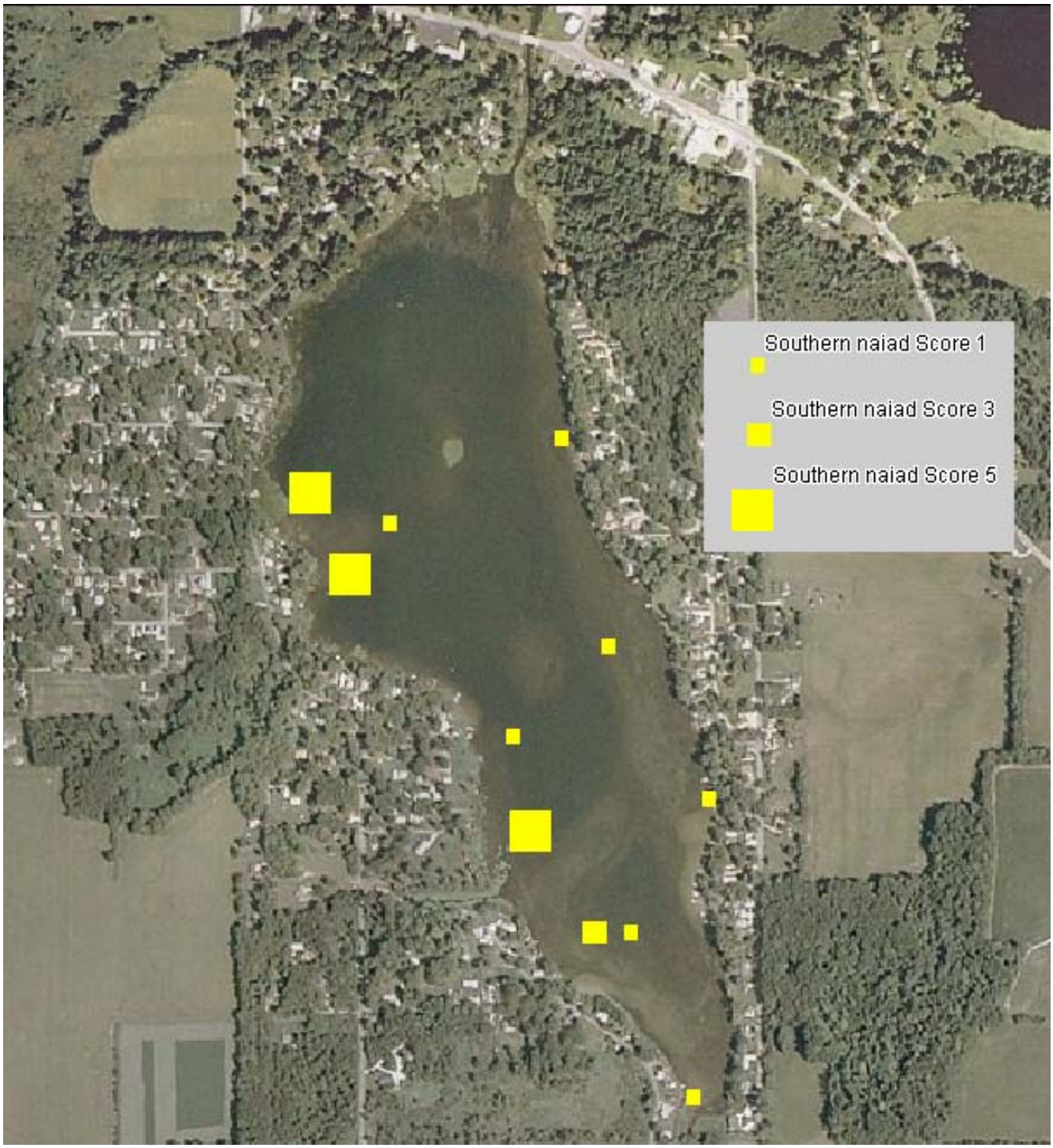


Figure 18 7/30/07 Southern naiad Map for Lower Fish Lake

8.3 Macrophyte Inventory Discussion

8.3.1 Statistical Descriptor Discussion for Both Lakes

Statistical descriptor data for the July 30, 2007 surveys for both lakes and comparison data for a set of 21 sampled Indiana lakes (Pearson 2004) is contained in tables 15 and 16 above. During the Tier II survey plants were found to be growing to a depth of 10.5 feet in Upper Fish and 13 feet in Lower Fish. Secchi depth readings on both lakes were 5 feet at the time of the survey. This was below the mean Secchi reading of 5.9 feet for lakes in the region in years 1999-2003 (SPEA 2006). Indiana Clean Lakes Program water quality data for Fish Lakes for July, 1999 showed a 7.9 foot Secchi depth for Lower Fish and a 5.2 foot reading on Upper Fish (SPEA 2006). In 2006 Secchi depths of 4.3 feet and five feet for Upper and Lower Fish respectively (JF New 2006) were recorded and at that time plants occurred to a depth of 15 feet on both lakes. Considering that the maximum depth of plant growth in a lake is generally determined by water clarity it appears that a 15 foot maximum sampling depth would be appropriate for future surveys on Upper Fish. However, on Lower Fish where a 7.9 foot Secchi depth was recorded in 1999 the potential probably exists for plants to grow beyond 15 feet during years of better water clarity, so the maximum sampling depth of 20 feet may be appropriate. Improving water clarity could potentially improve native plant growth and diversity at Fish Lakes and allow vegetation to grow at deeper depths. Both Upper and Lower Fish Lake displayed above average diversity when compared with a set of 21 other surveyed Indiana Lakes (Pearson 2004). A larger number of species is typically indicative of limited disturbance and good water quality that provides good native fish and wildlife habitat. Eleven species were identified from both Upper and Lower Fish compared to a 21 lake average of eight. Nine native species were noted in Upper Fish and 10 in Lower Fish compared to a 21 lake average of seven. At .82 and .86 respectively the calculated species diversity index numbers for both Upper and Lower Fish Lakes were notably higher than the 21 lake average of .66.

8.3.2 Upper Fish Lake Species and Depth Specific Survey Discussion

Species specific data and general 7/30/07 Tier II survey data for Upper Fish Lake is contained in tables five though nine above. In Upper Fish Lake Coontail was the dominant plant overall, occurring at 47.5 percent of sampling sites. Chara was the second most common plant sampled occurring at 22.5 percent of sites. Slender naiad was third most common, being sampled at 17.5 percent of sites. Within the zero to five foot contour Chara was dominant occurring at 80 percent of sites with Slender naiad second occurring at 60 percent. Coontail and Vallisneria were third in terms of dominance each occurring at 40 percent of sampling sites. Between the five and 10 foot contours Coontail became very dominant occurring at 90 percent of sites. Vallisneria was second in terms of calculated dominance occurring at 10 percent of sites. Great Bladderwort was third most dominant occurring at 20 percent of sites. Coontail appeared to be the plant most tolerant of low light conditions being the only plant found between the 10 and 15 foot contours. It was recovered at 30 percent of sampling sites between 10 and 15 feet. Filamentous algae was only found within the zero to five and five to 10 foot contours, occurring at 10 percent of sampling sites in each zone.

Due to very successful prior treatment, Eurasian watermilfoil had little presence in Upper Fish Lake during the July 30 sampling, occurring at only 2.5 percent of sampling sites overall (a single site). It was only found between the zero and five foot contours. Curlyleaf pondweed is an invasive plant that generally occurs in the early season, with many plants dropping out naturally prior to late July. It would, however still be expected to occur at moderate levels in a late July survey if it remained untreated. It appeared to also have been successfully reduced by treatment to insignificant abundance, occurring at only 2.5 percent of sites. It was recovered only between the five and 10 foot contours. With both non-native species at 2.5 percent occurrence a reasonable treatment response benchmark for

future seasons would be to hold the occurrence of both these plants to five percent or less of sampling sites in a late-season Tier II survey.

Figures 12-15 above display the sites of occurrence and rake scores for the four most dominant plant species in Upper Fish Lake. It appears that Coontail may respond to disturbance or nutrient rich environments positively in Upper Fish Lake, occurring heavily near the tributary inlets and on Mud Lake. For the other three mapped species, distribution appeared to be skewed toward a higher occurrence away from these areas, especially in the case of Vallisneria which was not recovered in any sampling near the tributary deltas. Vallisneria has been known in some cases to have a low tolerance for sedimentation. This indicates that minimizing nutrient/sediment inputs from the lake's tributaries could help boost plant diversity near the north end of Upper Fish Lake. It's appears from the exotic plant mapping (figures 3,4,6,7,8) that both Curlyleaf pondweed and Eurasian watermilfoil are occurring in a colonization pattern indicative of a source of disturbance or enrichment originating from the tributaries in Upper Fish Lake. Eurasian watermilfoil was noted recovering from treatment in this area during the July 30, 2007 survey. It should be noted that propogule introduction via these tributaries could also play a role in this distributional pattern. A 2007 season check of the Fish Creek flora approximately one half mile upstream of Upper Fish Lake revealed only native plants growing in the streambed, but additional basins upstream of the Fish Lakes could still be contributing exotic plant fragments to the Fish Lake Basins. The occurrence of these invasive plants in this delta region could also bear some responsibility for the reduction in the presence of native plants there. If heavy colonization by the exotics occurred for a long enough period of time prior to the onset of management activities competitive exclusion of native species may have depleted the native plant seed bank in this area. No rare, threatened or endangered species were recovered in the sampling for Upper Fish Lake.

Figure 19 A small Eurasian watermilfoil colony had reappeared in a Treated Area Near The Upper Fish Lake Tributary Deltas and was Flowering During the July 30, 2007 Survey.

8.3.3 Lower Fish Lake Species and Depth Specific Survey Discussion

Species and depth specific data and general 7/30/07 Tier II survey data for Lower Fish Lake is contained in tables 10 though 14 above. In the Lower Fish Lake Tier II survey Chara was dominant overall. It occurred at 27.5 percent of sampling sites. Vallisneria was second in dominance and first in occurrence by far, showing up at 40 percent of sampling sites. Southern naiad was third in dominance and occurred at 27.5 percent of sites. Within the zero to five foot contours Vallisneria was dominant

and occurred at 60 percent of sites, Chara was second occurring at 40 percent of sites and Southern naiad was third in dominance with a 50 percent occurrence. In the five to 10 foot contour zone Chara dominated, occurring at 50 percent of sites. Vallisneria ran second in dominance with an occurrence at 50 percent of sites and Southern naiad was third with an occurrence at 40 percent of sites. In the 10-15 foot contour zone Chara was again dominant with an occurrence at 20 percent of sites, Vallisneria was second in dominance, but occurred at 50 percent of sites. Coontail was third in dominance with an occurrence at 30 percent of sites. In the 15-20 foot zone only filamentous algae was found, occurring at 10 percent of sites. Filamentous algae occurred in every zone except the 5-10 foot zone.

No Curlyleaf pondweed was noted in the survey, but Eurasian watermilfoil occurred at 12.5 percent of sampling sites. Little Eurasian watermilfoil was visually observed during the survey, so growth was likely short and may have been widely scattered. This indicates a high likelihood for problem-level regrowth however, and significant treatments were indeed performed in August and again in November to control returning milfoil. Based on the Tier II results reasonable treatment response benchmarks for Lower Fish Lake in 2008 would be to hold the occurrence of Eurasian watermilfoil to 10 percent of sampling sites or less, and hold Curlyleaf pondweed occurrence to five percent of sampling sites or less in a late-season Tier II survey.

Figures 16-18 above display sampling maps for the three dominant species in the Lower Fish Lake Tier II sampling. The spatial distribution of Chara and Vallisneria appeared to be relatively even across the lakes littoral zone. Southern naiad however, was most heavy in occurrence along the lake's west shoreline. This plant may favor the finer and richer substrate of the West shore where less wind driven wave action occurs. The wave action on the East shore may result in a coarser sandier substrate with fewer organic materials.

Exotic plants (figures 3, 4, 7, 8) occur most heavily at the north end of Lower Fish Lake. This could be the result of initial introductions of these plants originating from the public access just upstream of this area, Upper Fish Lake, or it could be due to nutrient and sediment enrichment originating in the channel between Upper and Lower Fish Lakes. This nutrient enrichment could originate in drainage joining the channel between the lakes, septic sources, or even the continual resuspension of sediment that occurs when boats journey between the lakes. Minimizing the introduction of pollutants in this area could have positive implications for long term efforts to control invasive plants in this area. Taking care to avoid new introductions from the public access upstream of this area will also be important. No rare, threatened, or endangered species occurred in the sampling for Lower Fish Lake.

9.0 Aquatic Vegetation Management Alternatives

For a complete list of management options See *Aquatic Plant Management Plant Management Plan for Upper and Lower Fish Lakes, La Porte County Indiana* (Weed Patrol Inc. 2005) For the 2008 season two management options are presented. Both options recommend the chemical control of Curlyleaf pondweed and Eurasian watermilfoil. Option one calls for a "whole lake" treatment using fluridone (Sonar) aquatic herbicide. Fluridone is persistent enough to remain the lakes waters for a considerable period of time, mixing throughout the lake and having a slow and gradual affect on the lake's aquatic plants. It is recommended to apply a six ppb (part-per-billion) dose to be followed up with bump applications as needed to maintain a concentration of at least 3ppm for 60 days or longer. This will gradually control both Eurasian watermilfoil and Curlyleaf pondweed with the plants dropping out completely by the end of the season. These two invasive plant species will be most affected by the treatment with effects on most native species being minimal. Curlyleaf pondweed will return at or near its previous growth area after 2008, but Eurasian milfoil growth will be relatively minor in 2009, with milfoil then gradually recolonizing the lake over the next few years. In 2009-2011 maintenance treatments will be performed to kill Eurasian watermilfoil as it returns and early season treatments for

Curlyleaf pondweed should proceed in 2009 through 2011. Option two provides for essentially the same treatment regime as in 2007. Contact herbicides (Aquathol K liquid) will be used to perform an early season treatment on all Curlyleaf pondweed in 2009 and systemic herbicides (2,4-D) would be used to treat all notable Eurasian watermilfoil growth as it appears. With either treatment regime the results of the experimental fall treatment in 2007 should be examined to determine if shifts to more optimal herbicides or treatment timing should occur.

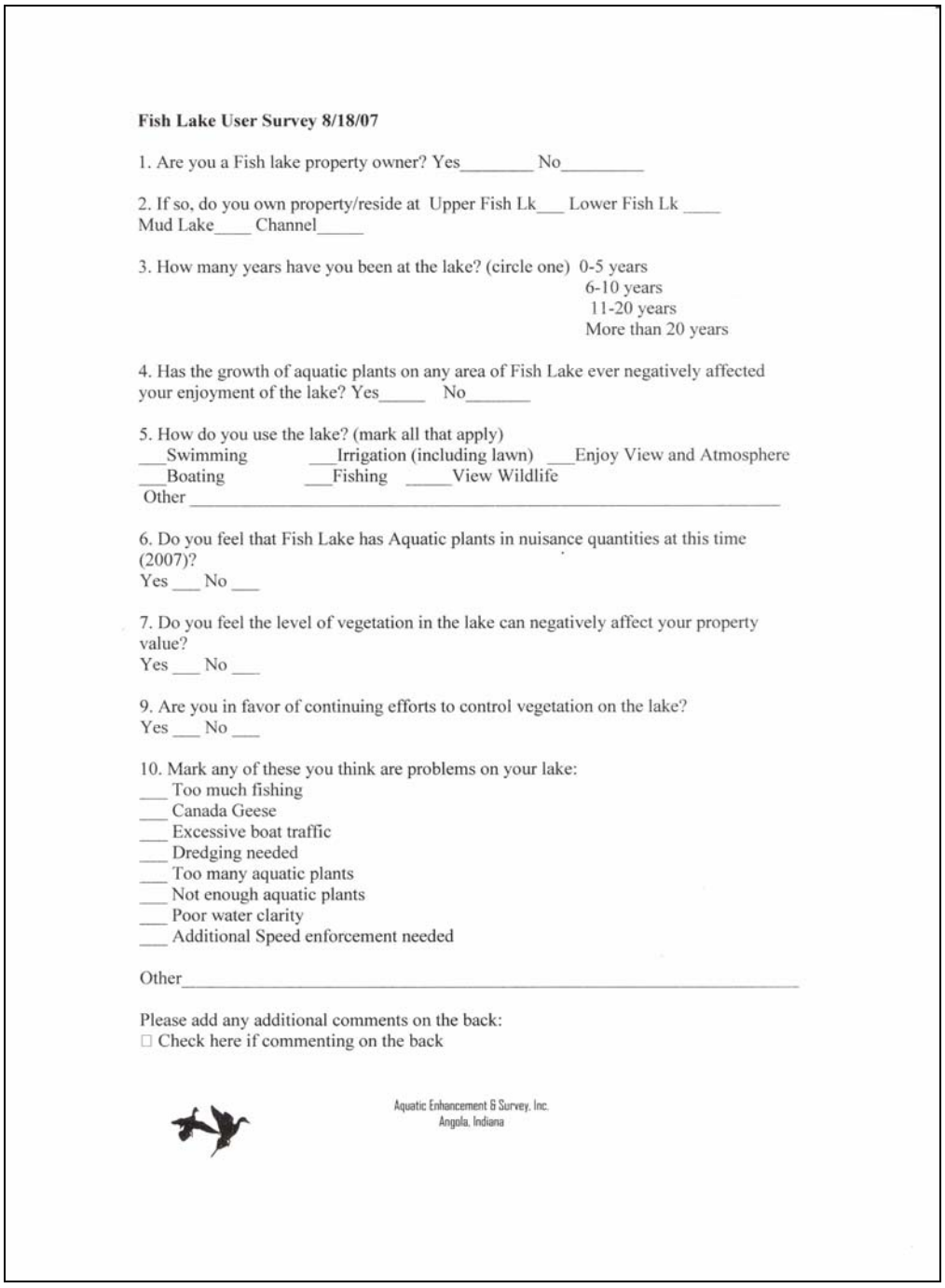
10.0 Public Involvement

The public meeting for the Fish Lake aquatic plant management was held on Saturday August 18, 2007 at the Fish Lake Conservation Club. The meeting was incorporated into the regular Fish Lake Conservancy District business meeting. The meeting was attended by approximately 35 people. Goals for the meeting included the following:

- Present attendees with an overview of the Land and River Enhancement Program, its funding, structure, and contributions to exotic plant management at Fish Lake.
- Outline the plant survey and plant control process underway at Fish Lake including management options and objectives.
- Provide a comparison of this years Tier II findings with last years
- Help attendees to be able to recognize Curlyleaf pondweed and Eurasian watermilfoil and understand their life processes, history, and potential for spread and negative impact.
- Leave attendees with an understanding of the next steps for Fish Lake in the plant management process.
- Answer any questions attendees may have in regard to aquatic pesticide applications, water-use restrictions or aquatic plant communities and allow public comments regarding plant management at Fish Lakes.

Meeting attendees were presented with a printed handout containing comparison Tier II descriptor data from 2006 and 2007. Curlyleaf pondweed, Eurasian watermilfoil, Phragmites, and Purple Loosestrife plants were provided to better enable attendees to recognize these plants in the lake and watershed. The public meeting survey below (figure 20) was handed out and attendees were asked to complete one survey per household. Thirteen surveys were returned. Eleven respondents (85%) were Fish Lake residents. Three respondents were residents of Upper Fish Lake, four were from Lower Fish Lake, three reside on Mud Lake and one reported being a resident of the Channel between the two lakes. When asked how many years they had owned property/resided at the lake two reported 0-5 years, none reported 6-10 years, two reported 11-20 years, and seven reported more than 20 years. Seven respondents reported that aquatic plants had negatively affected their enjoyment of the lake at some point, two said they had not. When respondents were given a list of six lake-activities and asked to mark each they participate in nine (69%) marked fishing, eight (62%) marked swimming and eight also marked boating. Seven indicated that they enjoy the viewing of wildlife as an activity, while six marked that they enjoy the view and atmosphere while at the lake. Two respondents indicated that they use the lake for irrigation. When asked if Fish Lakes had nuisance quantities of aquatic plants in the 2007 season 10 (91% of 11 respondents) said “yes” while only one marked “no”. Ten indicated the level of vegetation in the lake could affect their property values while only one said it did not. All respondents were in favor of continuing efforts to control vegetation at the lake. When asked to choose from a list of common “lake problems” to indicate which were problems at Fish Lakes, eight (62%) indicated “too many aquatic plants” were a problem. Eight also indicated “dredging needed”. Seven indicated Canada geese were a problem, six pointed to “poor water clarity” as a problem, three indicated that additional speed enforcement was needed, and one said “excessive boat traffic” was an issue. Respondents were encouraged to place additional comments on the back of the survey. One

indicated that purple loosestrife and the excessive growth of lily pads should be addressed. Overall the surveys and comments received at the meeting indicated that the users of Fish Lakes held the control of exotic plants to be a high priority to maximize their enjoyment of lake activities and were in favor of continued management.



Fish Lake User Survey 8/18/07

1. Are you a Fish lake property owner? Yes_____ No_____

2. If so, do you own property/reside at Upper Fish Lk___ Lower Fish Lk ____
Mud Lake____ Channel_____

3. How many years have you been at the lake? (circle one) 0-5 years
6-10 years
11-20 years
More than 20 years

4. Has the growth of aquatic plants on any area of Fish Lake ever negatively affected your enjoyment of the lake? Yes_____ No_____

5. How do you use the lake? (mark all that apply)
___Swimming ___Irrigation (including lawn) ___Enjoy View and Atmosphere
___Boating ___Fishing _____View Wildlife
Other _____

6. Do you feel that Fish Lake has Aquatic plants in nuisance quantities at this time (2007)?
Yes ___ No ___

7. Do you feel the level of vegetation in the lake can negatively affect your property value?
Yes ___ No ___

9. Are you in favor of continuing efforts to control vegetation on the lake?
Yes ___ No ___

10. Mark any of these you think are problems on your lake:
___ Too much fishing
___ Canada Geese
___ Excessive boat traffic
___ Dredging needed
___ Too many aquatic plants
___ Not enough aquatic plants
___ Poor water clarity
___ Additional Speed enforcement needed

Other_____

Please add any additional comments on the back:
☐ Check here if commenting on the back

Aquatic Enhancement & Survey, Inc.
Angola, Indiana

Figure 20 Fish Lake User Survey

11.0 Public Education

Efforts at public education should continue as outlined in Weed Patrol, Inc. 2005 and JF New 2006 & 2007. The six Fish Lake Conservancy District meetings held each year should be utilized as opportunities to help educate lake users. Users should be familiarized with all relevant invasive species and their spread. Information on Hydrilla in the section below should help to raise awareness of this new invader and help Fish Lake users recognize this plant.

11.1 Hydrilla and it's implications for Fish Lakes

Keeping lake residents and users aware of the possibility of bringing in new invasive species on watercraft trailers will be especially important now that Hydrilla has been found in Indiana. Hydrilla *Hydrilla verticillata* is an invasive submersed aquatic plant thought to be native to Africa, Australia, and parts of Asia. As a hearty growing plant Hydrilla was used in aquariums and this led to its introduction into Florida waters in 1960. Since then Hydrilla has spread to become the single most problematic plant in the United States. (See USGS map below) In Florida alone millions are spent in controlling the growth of Hydrilla each year. The potential exists for the same type of damage on Indiana waterways if Hydrilla is allowed to spread. Like many invasive aquatic plants Hydrilla can form dense surface mats depriving native plant communities of light, decreasing plant community diversity, and causing serious impairment of recreational activities including fishing, swimming, and boating.

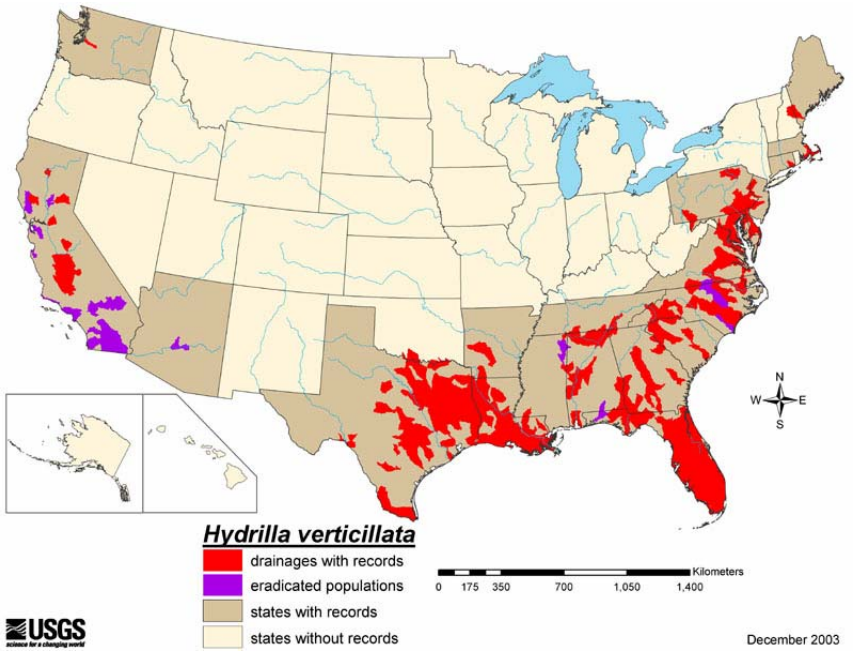


Figure 21 Known occurrences of Hydrilla in the U.S. in 2003. From the USGS website, http://nas.er.usgs.gov/taxgroup/plants/docs/hy_verti.html

Figure 22 Hydrilla mats clog the surface of Lake Conroe Texas. Photo courtesy of Earl Chilton, Texas Parks and Wildlife Department

Hydrilla can spread by fragmentation or the production of seeds, tubers (root structures), or turions (seed-like plant buds). Because of the potential for spread through fragmentation, plant material hitching a ride on watercraft trailers is probably a major mechanism of introduction. Tubers and turions can be very hearty, surviving dry periods or herbicide treatments and remaining hidden in the lake bottom for extended periods of time. Because of these characteristics great ecological damage and recreational impairment can occur in watersheds colonized by Hydrilla. In 2006 Hydrilla was discovered in Lake Manitou and its outlet stream 38 miles southeast of Fish Lakes in Rochester Indiana (Fulton County). This is the first known occurrence of this plant in the Midwest. The Indiana Department of Natural Resources has devised a plan for eradicating and controlling the Hydrilla to prevent spread to other water bodies. Checks of other lakes in close proximity to Lake Manitou have not located any Hydrilla, so it is possible that the plant is only in and immediately downstream of Lake Manitou at this time. However, it's also possible that other lakes contain young Hydrilla infestations that have yet to be recognized so it's important that associations and lake residents learn to identify this plant. Acting early in spotting Hydrilla can help prevent spread and ultimately save a huge cost to the ecology and recreational value of Indiana lakes. At some point other infestations may occur as a result of plants being transported to Indiana from out-of-state. Whereas Upper and Lower Fish Lakes are a popular boating and sportfishing destination, there is a definite possibility that this plant could appear in the lakes in the future. Information on Hydrilla identification should be presented to the Lake users at meetings as a regular part of the lake resident educational program.

Figure 23 Hydrilla is similar in appearance to the native plant Elodea and also Brazilian elodea, an exotic (also recently found in Indiana). It forms long stems containing many whorls of short leaves. Photo Courtesy of Dr. John H. Rodgers, Jr.

11.1.1 Hydrilla Identification

Hydrilla strongly resembles the native aquatic plant Elodea *Elodea canadensis* and the introduced species Brazilian elodea *Egeria Densa.* Both these species can be found in Indiana although the occurrence of Brazilian elodea has been very limited thus far. Hydrilla is a long slender plant that sometimes branches and has short leaves arranged around the stem in a star-like (whorled) pattern. Characteristics which differentiate Hydrilla from Elodea and Brazilian Elodea include a typical leaf count of five in the whorl. Brazillian elodea typically has four to six leaves but never three, and native Elodea (found at Fish Lakes) usually has three. (fig 24) Small teeth are also present on the midrib of Hydrilla leaves and may give the plant a "rough" feel. Hydrilla also has small serrations along the leaf edges (fig 25). Another distinguishing characteristic of Hydrilla is the presence of tubers (.2 to .4 inch long off-white structures attached to the root) (fig 26).

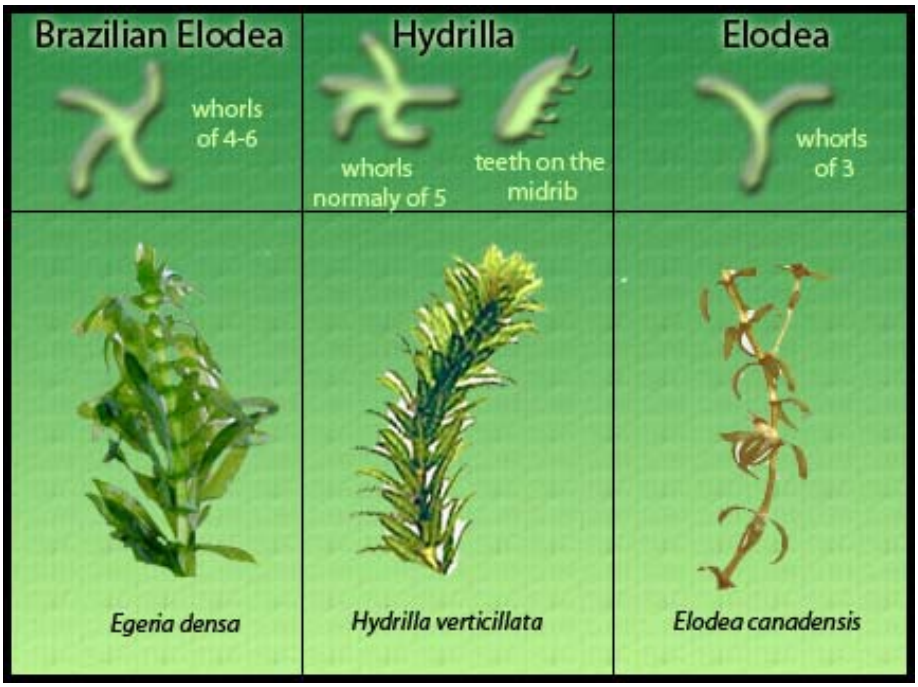


Figure 24 Brazilian elodea has a typical leaf count of 4-6, while Hydrilla's is usually 5, and Elodea's 3. Drawing courtesy of Rob Nelson at ExploreBiodiversity.com

Figure 25 Edges of Hydrilla leaves have fine serrations visible upon close examination. Photo Courtesy of Dr. John H. Rodgers, Jr.

Figure 26 Hydrilla plants with tubers attached. Photo courtesy of King County Natural Resources and Parks, Water and Land Resources Division.

Anyone noting the presence of Hydrilla or Brazilian elodea is asked to immediately contact Doug Keller, Invasive species coordinator for the Indiana Department of Natural Resources at 317-234-3883, email: **dkeller@dnr.in.gov**. If you have questions about the identity of aquatic plants found, photos of the plants can be e-mailed to Doug for basic identification to determine if further action is required. More information on stopping the spread of invasive aquatic species is available online at **http://www.protectyourwaters.net/**

12.0 Integrated Management Action Strategy

Exotic plant management at Fish Lakes should take an approach consisting of the three tiers of action below working toward this plan's primary goals as outlined in Weed Patrol, Inc. 2005:

Tier 1. Nutrient and Sediment control.
As with any group that cares for a lake the Fish Lake Conservancy District should be vigilant in spotting and addressing nutrient and sediment sources in the watershed, stopping pollutants at their source before water quality can be impacted. Feasibility studies already completed in 1990 and 1991 with IDNR Cost-share assistance have helped address issues in the watershed. Study results and projects completed since should be reviewed periodically to assess whether additional work can be done, previous work upgraded, or previous projects updated or maintained.

Tier 2. Public Education.
Educating lake users about the spread of invasive species can potentially prevent a very costly infestation of new exotic plants and animals at the lakes, saving resources that can be utilized to address current problems. Conservancy residents should also be made aware of land-use practices on their own ground that can assist in keeping nutrients out of the lake.

Tier 3. Exotic Plant Control.
Addressing the submersed aquatic non-native plants present on a lakewide basis with professional applications of EPA approved aquatic pesticides and monitoring results closely can potentially limit their spread and preserve the native plant community while providing relief to lake users. The proposed chemical treatment regimes are detailed in the budget and timeline in the next section. Two options are presented. Option one proposes a whole lake fluridone treatment on both lakes in 2008 to control both Curlyleaf pondweed and Eurasian watermilfoil on lakewide basis on both lakes. This is an option that was not presented as a recommendation in the original plan. Option two proposes the early season application of Aquatic K aquatic herbicide to 60 acres of Curlyleaf pondweed to provide seasonal control and also prevent turion formation that promotes Curlyleaf growth in later seasons. It also proposes the application of 2,4-D granular aquatic herbicide to 81 acres of Eurasian watermilfoil growth as needed. A treatment response benchmark of holding Eurasian watermilfoil's late-season Tier II occurrence to five percent or less on Upper Fish Lake and 10 percent or below on Lower Fish Lake should be pursued. For Curlyleaf pondweed holding the late season Tier II occurrence on both lakes below five percent should be an attainable goal with control of all significant Curlyleaf achieved with an early season (April) treatment that precludes turion production.

12.1 Direct Control Options

12.1.1 Herbicidal Control Option 1: *Recommended-Lakewide Control of Eurasian Watermilfoil and Curlyleaf pondweed with the use of Sonar Aquatic Herbicide at an application rate of 6 ppb. Contact/Systemic herbicide use for Curlyleaf and Milfoil regrowth in later seasons

Preliminary calculations indicate the Fish Lakes have a hydraulic residence time that allows for a dosing of the lake basins with a persistent slow-acting herbicide called fluridone (trade name Sonar). This "whole lake" type of treatment will begin with a May application of enough fluridone herbicide to produce a concentration of approximately 6 parts-per-billion in Fish Lakes initially, and a concentration of approximately 3ppb for an extended period of time. The initial dosage should be determined by assessing lake stratification prior to treatment. Dosage should be calculated based upon the depth of the thermocline with the assumption that extensive mixing of fluridone with lake waters below the thermocline is unlikely. 48 hours after this application, a series of lake-water assay samples (at least one from each basin) will be collected and the fluridone level measured. If the fluridone level is below 3ppb, enough herbicide will be added to "bump" the concentration up to approximately 6 ppb. These assays will be repeated at 10 days, 21 days, 35 days, and 60 days with a "bump" dosage occurring as necessary to maintain approximately 3ppb during the sampling period. Over the course of 60 to 90 days the Eurasian watermilfoil and Curlyleaf pondweed in Fish Lakes should gradually become unhealthy as the herbicide acts. By the end of the season both plants should be largely controlled.

A problem-level return of Eurasian milfoil growth is unlikely in the following season, but plants spotted should be treated with systemic herbicides. As the milfoil gradually returns during the seasons following fluridone treatment, systemic herbicides can be used to target the growth and maintain control. Repeated seasonal tier II plant surveys will be used over the four year control plan to evaluate the control effectiveness and any negative impacts on desirable native plants. For planning purposes it is assumed the area recolonized by milfoil will have increased by 2012 to the point where another whole-lake treatment is warranted in that season.

One possible drawback to whole-lake fluridone treatment is damage to native vegetation. Generally Curlyleaf pondweed and Eurasian watermilfoil are much more sensitive to fluridone treatment than most native plants, so selectivity spares most native plants damage. Overall damage to native plants more extensive than that caused by the exotic colonization is not likely, but it must be considered as a possibility. There is also a possibility that water clarity will suffer after removal of the Exotics. Generally the presence of a healthy native plant population like that present in Fish Lakes can help offset this risk by maintaining a significant plant biomass to help maintain system balance.

The plan timeline for this option calls for treatment of regrowth of milfoil during seasons two through four (2009-2011). Early season treatment of Curlyleaf pondweed will also be performed during years two through four to reduce turion numbers and prevent a shift to Curlyleaf as a new major problem plant. The Fish Lake Conservancy District may elect to continue treatments for algae, Chara, and native plants on a limited basis in high recreational use areas as needed. Algae will not be controlled by the fluridone treatment and there will be little or no control of native plant growth. The total cost estimate for the 2008 fluridone treatment/monitoring is $36,052.00. This estimate is based on a "worst case scenario i.e. a very rainy spring season, significant error in the residence time calculation, and a 15 foot deep thermocline at the time of treatment. This estimate could be adjusted at the option of the applicator to reflect the costs of the actual amount of product used. With this treatment scenario results of the fall experimental treatment in 2007 should be evaluated early in the spring of 2008 before the fluridone has affected milfoil growth in the experimental areas. Results should be taken into

account and planning for control in later seasons adjusted appropriately when treatment begins on returning milfoil in later seasons. A check should also be performed on bodies of water in the Fish Creek watershed, upstream of Fish Lakes to determine the extent of sources of new milfoil fragment introduction that may be addressed. Costs under this option will be considerably less than those estimated for option 2 below. The total cost of pesticide applications for exotic plants through 2011 under this option is $161,212.00. The total estimated cost of option 2 below through 2011 is $206,460.00. Option one is estimated to provide a savings of $45,248.00 in years 2008-2011. The primary reasons for the recommendation toward this option are cost-effectiveness and completeness of exotic plant control. Excessive negative impacts to native vegetation and lake ecology in general are not likely.

12.1.2 Herbicidal Control Option 2

Granular 2-4-D Use for Eurasian watermilfoil / Contact herbicide use for Curlyleaf

This option essentially continues the current program. Granular 2,4-D (Navigate) has proven efficacious at Fish Lakes in past treatments. In 2008 it should be used at the rate of 100 lbs. per surface acre to treat Eurasian watermilfoil as it appears, beginning in the month of May. Repeated treatments may be necessary (as in 2007) to maintain control of regrowing or newly emerging plants throughout the season. Curlyleaf pondweed should be treated with Aquathol K liquid herbicide at the rate of .5 to 1.5 ppm in April or Early May when water temperatures reach approximately 50 degrees Fahrenheit. This will decrease Curlyleaf reproduction by killing the plants before their turions (seeds) have reached viability. It is possible to eventually significantly decrease the amount of returning seasonal Curlyleaf growth with this method. The goal of the Curlyleaf control should be to treat all areas of nuisance level Curlyleaf pondweed growth before turions become viable. Based on the reported treatment in 2007 it is estimated that in 2008 a total of 60 acres of Curlyleaf pondweed will need treatment. The total cost estimate to treat this acreage is $18,000.00. Based on the reported acreage of Eurasian watermilfoil treated in 2007 it is estimated that up to 81 acres of Eurasian watermilfoil will need treatment. These treatments should seek a treatment response benchmark of reducing the amount of Eurasian watermilfoil enough to produce a Tier II occurrence of five percent of sampling sites or less on Upper Fish Lake and 10 percent or less on Lower Fish Lake. The estimated cost of these milfoil treatments is $33,615.00. The results of the experimental treatment from 2007 should be evaluated during the 2008 season with an appropriate change in strategy implemented in future seasons based on the results. This option is similar to the original plan budget for year 2006 where it was estimated 96 acres of Eurasian milfoil would be treated with systemic herbicides and 60 acres of Curlyleaf pondweed would be treated with contact herbicides. The total cost estimate for exotic plant treatment for 2006 in the original plan was $47,000.00. This compares to an estimate of $51,615.00 for 2008 in this update. Cost differences are based mainly on a higher per-acre treatment costs in the current estimate. The original plan estimated that the exotic treatment acreage would decrease in 2007 through 2009 stepping costs down each season considerably (see chart below). The decrease in acreage treated for non-native plants has not yet materialized to the extent estimated in the original plan. The current update estimates that treatment acreage will remain similar through 2011. If long term control efforts are successful (using option two) and the decrease in treated acreage occurs in later seasons the plan/updates should be adjusted accordingly. Likely treatment areas for 2008 are shown in figures 27 and 28 below.

Year	Exotics (LARE)
2006	$47,000.00
2007	$20,250.00
2008	$18,250.00
2009	$12,250.00

Table 17 Original four year plan annual treatment estimates (Weed Patrol Inc.)

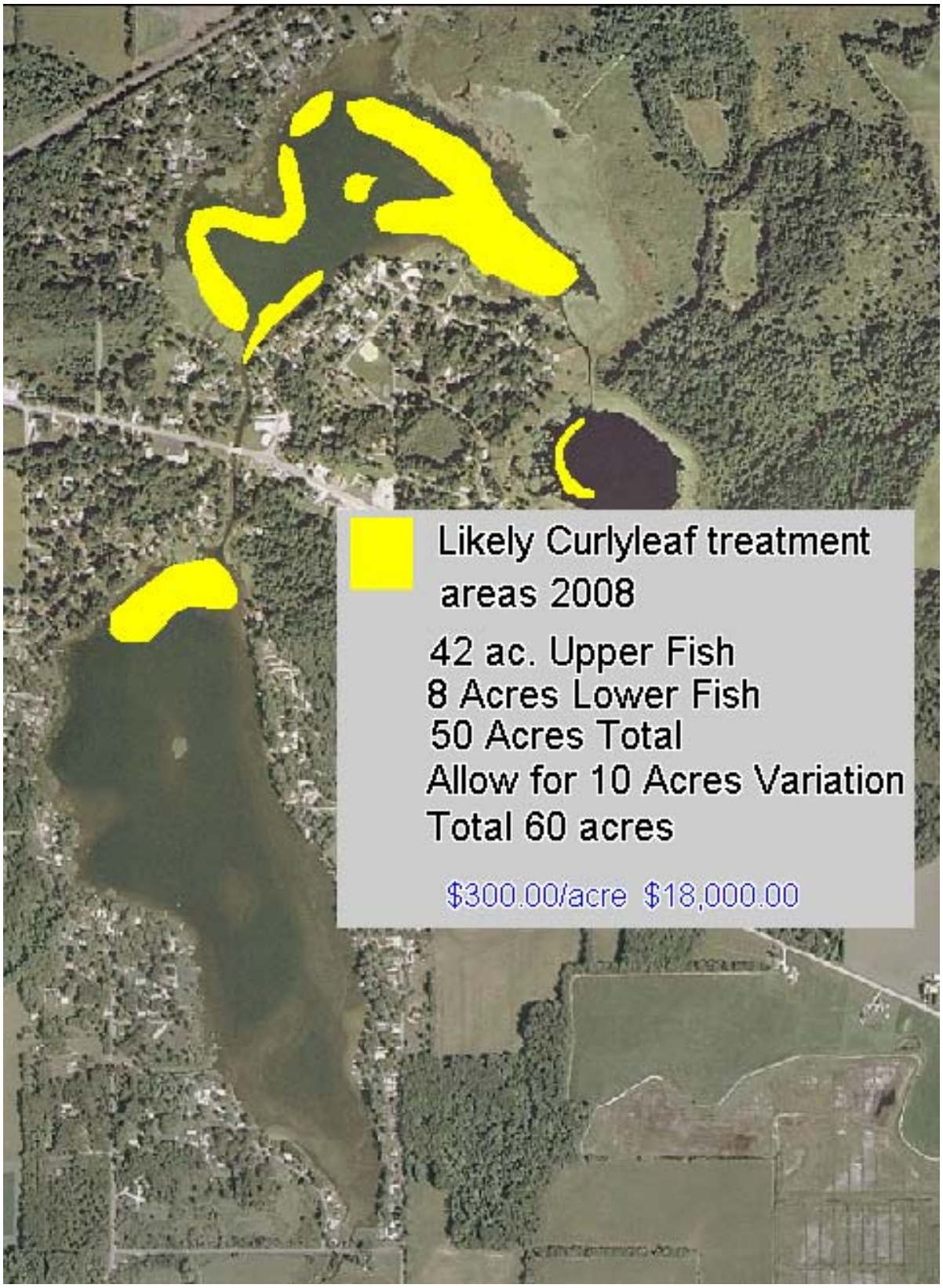


Figure 27 Likely Area of Curlyleaf pondweed Treatment in 2008

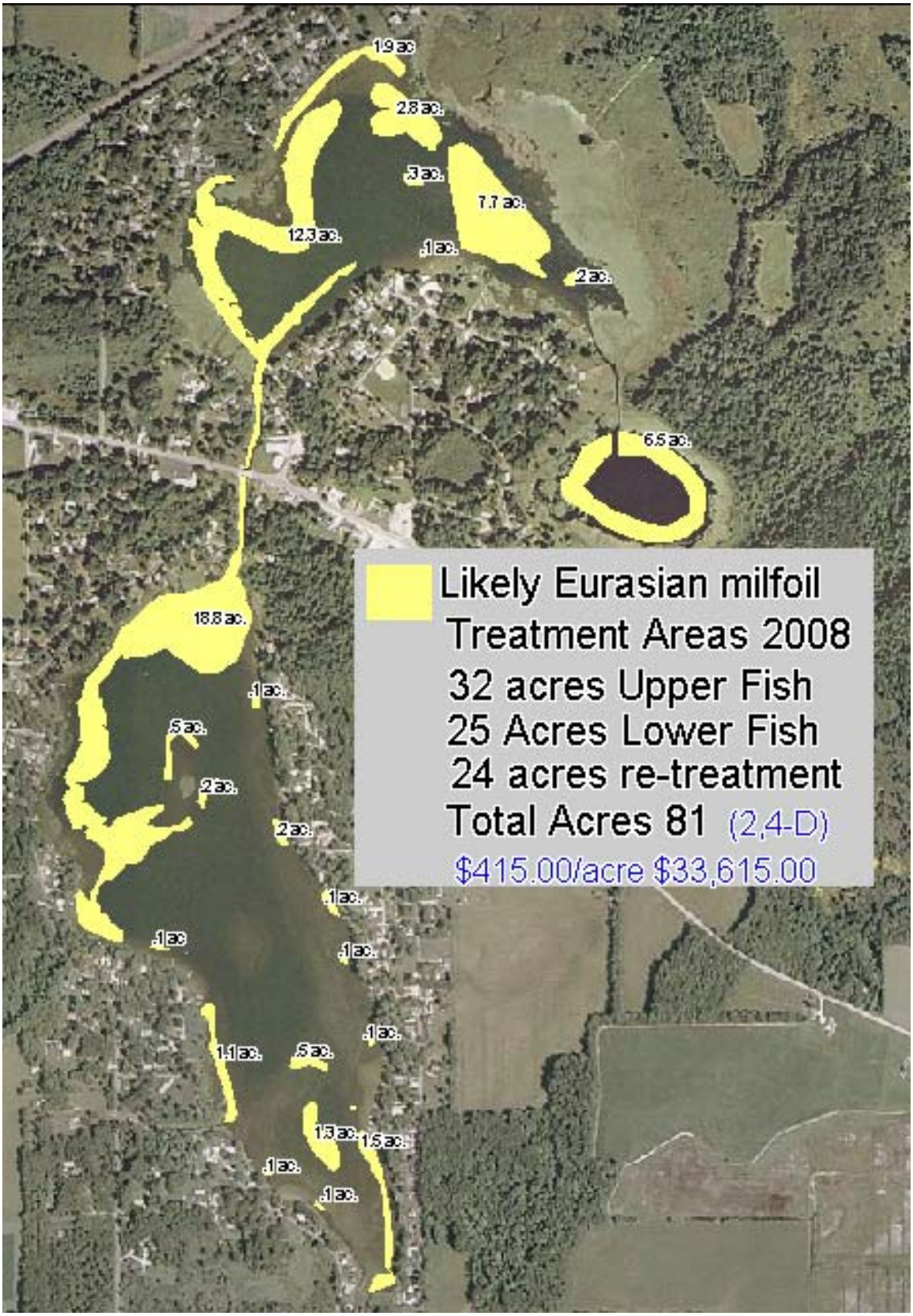


Figure 28 Likely Area of Eurasian watermilfoil Needing Treatment in 2008

13.0 Project Budget & Timeline
*note cost estimates allow for approximate 5% price increase per year after 2008

Herbicidal Option 1, Fluridone (6ppb bump 6)

2008 Season **Treatment response benchmarks:** Maintain a late season Tier II occurrence of 5% or less for Eurasian watermilfoil and Curlyleaf pondweed on Upper Fish Lake. For Lower Fish maintain 10% or less on Eurasian watermilfoil and 5% or less on Curlyleaf. Provide effective relief of both in problem areas.		
Month	**Activity**	**Cost Estimate**
May 2008	Map Curlyleaf pondweed And Eurasian watermilfoil growth, evaluate results of experimental treatment in 2007	1100.00
May 2008	6 ppb fluridone application	Initial dose, bump, assays
	Collect 48 hour assay	36052.00
	Collect 10 day assay	
June 2008	Bump dosage (as needed)	
	Collect 21 day assay	
	Collect 35 day assay	
	Algae/native plant treatment as needed	(FLCD costs)
July 2008	Collect 60 day assay	
	Tier II Survey	1400.00
	Algae/native plant treatment as needed	(FLCD costs)
August 2008	Fish Lake Public Meeting	400.00
October/November 2008	Permit Meeting	300.00
December 2008	Plan Update Document Due	1600.00
	2008 Total Cost, Pesticide Applications	**$36052.00***
	2008 Total Cost, Consultant	**$4800.00**
	Total	**$40,852.00***
		***(does not incl. algae or native plant treatment costs)**

2009 Season		
Month	**Activity**	**Cost Estimate**
April	Map Curlyleaf pondweed And Eurasian watermilfoil growth	1155.00
	Treat 60 ac. Curlyleaf pondweed	18900.00
May	Treat estimated 10 acres of Eurasian watermilfoil as needed	4360.00
June	Algae/native plant treatment as needed	(FLCD costs)
July	Treat estimated 10 acres of Eurasian watermilfoil as needed	4360.00
	Tier II Survey	1470.00
	Algae/native plant treatment as needed	(FLCD costs)
August	Fish Lake Public Meeting	420.00
October/November	Permit Meeting	315.00
December	Plan Update Document Due	1680.00
	Total Cost, Pesticide Applications	**$27,620.00**
	Total Cost, Consultant	**$5040.00**
	Total	**$32,660.00**
		***(does not incl. algae or native plant treatment costs)**

2010 Season		
Month	**Activity**	**Cost Estimate**
April	Map Curlyleaf pondweed And Eurasian watermilfoil growth	1213
	Treat 60 ac. Curlyleaf pondweed	19,860.00
May	Treat estimated 20 acres of Eurasian watermilfoil as needed	9160.00
June	Algae/native plant treatment as needed	(FLCD costs)
July	Treat estimated 20 acres of Eurasian watermilfoil as needed	9160.00
	Tier II Survey	1544.00
	Algae/native plant treatment as needed	(FLCD costs)
August	Fish Lake Public Meeting	441.00
October/November	Permit Meeting	331.00
December	Plan Update Document Due	1764.00
	Total Cost, Pesticide Applications	**$38180.00**
	Total Cost, Consultant	**$5293.00**
	Total	**$43473.00**
		***(does not incl. algae or native plant treatment costs)**

2011 Season		
Month	**Activity**	**Cost Estimate**
April	Map Curlyleaf pondweed And Eurasian watermilfoil growth	1273.00
	Treat 60 ac. Curlyleaf pondweed	20880.00
May	Treat estimated 40 acres of Eurasian watermilfoil as needed	19240.00
June	Algae/native plant treatment as needed	(FLCD costs)
July	Treat estimated 40 acres of Eurasian watermilfoil as needed	19240.00
	Tier II Survey	1621.00
	Algae/native plant treatment as needed	(FLCD costs)
August	Fish Lake Public Meeting	463.00
October/November	Permit Meeting	347.00
December	Plan Update Document Due	1852.00
	Total Cost, Pesticide Applications	**$59360.00**
	Total Cost, Consultant	**$5556.00**
	Total	**$64916.00**
		***(does not incl. algae or native plant treatment costs)**

Herbicidal Option 2, (same treatment regime as in 2007)(repeated annually for 2008 - 2011)

2008 Season **Treatment response benchmarks:** Maintain a late season Tier II occurrence of 5% or less for Eurasian watermilfoil and Curlyleaf pondweed in Upper Fish. For Lower Fish maintain 10% or less on Eurasian watermilfoil and 5% or less on Curlyleaf. Provide effective relief of both in problem areas.		
Month	**Activity**	**Cost Estimate**
April 2008	Map Curlyleaf pondweed And Eurasian watermilfoil growth	1100.00
April 2008	Early season Curlyleaf treatment (60 acres) Aquathol K .5-1 ppm	18,000.00
May –August 2008	2,4-D treatment of Eurasian watermilfoil (81 acres)	33,615.00
	Algae/native plant treatment as needed	(FLCD costs)
	Tier II Survey	1400.00
	Algae/native plant treatment as needed	(FLCD costs)
August 2008	Fish Lake Public Meeting	400.00
October/November 2008	Permit Meeting	300.00
December 2008	Plan Update Document Due	1600.00
	2008 Total Cost, Pesticide Applications	**$51,615.00***
	2008 Total Cost, Consultant	**$4800.00**
	Total	**$56,415.00***
		***(does not incl. algae or native plant treatment costs)**

14.0 Monitoring and Plan Update Procedures

The Fish Lakes Aquatic Plant Management Program should continue to be monitored and updated on an annual basis. Monitoring will consist of monitoring not only the lake's plant community but the thoughts and opinions of the lake's users. To monitor the lake's plants, exotic growth should be remapped each spring and compared with the previous season's growth pattern. A tier II survey in the late season after treatment has been initiated will serve to characterize the lake's overall plant community statistically and also gage if treatment response benchmarks have been attained. If treatment response benchmarks are not attained changes in the treatment timing, chemical used, or integrated approach will all be options for setting a new course toward success. To monitor the thoughts and opinions of lake users at least one public meeting should be held annually and a survey distributed. An open forum at the meeting should exist to allow for discussion of water-use restrictions associated with treatments, new problems arising at the lake, or treatment effectiveness. Updates on program progress and developments should be issued in the Conservancy District's Newsletter.

15.0 Literature Cited

Weed Patrol Inc. 2005, Aquatic Plant Management Plant Management Plan for Upper and Lower Fish Lakes, La Porte County Indiana, Weed Patrol, Inc. 1922 Fieldhouse Ave., Elkart, Indiana, 46517, 574-389-3352

JF New 2006 & 2007, Fish Lake Aquatic Vegetation Management Plan Update 2006, La Porte County, Indiana, JF New 708 Roosevelt Road, Walkerton, Indiana, 46574, 574-586-3400

IDNR 2007, Tier II Aquatic Vegetation Survey Protocol, May 2007, Indiana Department of Natural Resources, Division of Fish and Wildlife, 402 W. Washington St. Rm W-273, Indianapolis, IN 46204

Pearson 2004, A sampling method to assess occurrence, abundance and distribution of submersed aquatic plants in Indiana lakes, Indiana Department of Natural Resources, Division of Fish and Wildlife, Tri-Lakes Fisheries Station, 5570 North Hatchery Road Columbia City, Indiana 46725

SPEA 2006, Indiana Lake Water Quality Assessment Report For 1999-2003, School of Public & Environmental Affairs, Indiana University, Bloomington, Indiana